Troubleshooting

Introduction

This chapter provides information for localizing defibrillator/monitor problems to the assembly level. This troubleshooting information is designed for use with the defibrillator's setup/diagnostic tests to efficiently repair the defibrillator with a minimum of equipment.

Maintenance Philosophy

The repair philosophy for the defibrillator is assembly replacement. Replaceable assemblies are identified in Chapter 7, **Parts Lists**.

CAUTION

Individual component replacement should not be attempted outside of an authorized HP repair facility. Component level repair is extremely difficult due to the extensive use of surface mount technology and the high parts-density on the circuit boards. Unauthorized component replacement can impair defibrillator performance.

Troubleshooting Guide

The following information suggests ways of using the information in this manual to troubleshoot defibrillator failures.

Verify the Failure

Before troubleshooting the defibrillator, make sure that the failure is not the result of improper use. See the *CodeMaster XL/XL+ User's Guide* for a condensed description of controls and their use.

The built-in diagnostic tests are useful for verifying some failures. See "Using Setup/Diagnostic Tests in Troubleshooting" on page 5-2 for a description of these tests.

Check the Error (System) Log

Print the error log to see if it contains an error code. You can clear the error log, operate the defibrillator and repeat the failure, and then print the error log to see if the failure created a new error code. See "The System Log" on page 5-4 for detailed information on error codes.

Using the Troubleshooting Tables

Check to see which functional areas of the defibrillator are affected. The troubleshooting tables organize symptoms by type: audible, displayed, and symptoms specific to a functional area of the defibrillator.

In the tables, find the symptoms that apply to the instrument failure.

Try the solutions suggested in the tables for the symptoms of your defibrillator.

Before replacing parts, check that cables and connectors are seated, check that boards are seated and look for damaged parts.

In the tables, replace the first board listed, since the board most likely to fail is usually listed first. Verify that the failure still exists; then, replace the next board listed.

After repair, verify that the defibrillator operates to specification. See "Verification after Repair" on page 5-2 for detailed information.

Using Setup/Diagnostic Tests in Troubleshooting

The setup/diagnostic tests are built-in, menu-driven tests that can quickly check defibrillator operation without the use of additional equipment. The tests check these functional areas:

Defibrillator Test	Checks defibrillator charging and verifies post shock data (Ipeak, delivered energy and patient impedance)
ECG (monitor) Test	Verifies monitor operation
CRT Test	Displays a test pattern
Recorder Test	Prints a test strip
Controls Test	Allows you to verify keypanel operation; on-screen indication gives direct feedback when a key is pressed
Indicators Test	Cycles the keypanel indicators so that you can verify LED operation; tests the CRT Alert tones.
Battery Test	Checks battery charge capacity

Instructions for entering and using setup/diagnostic mode are found in Chapter 3, **Performance Verification and Maintenance.**

Verification after Repair

After repairing the defibrillator, perform the tests described in Chapter 3, **Performance Verification and Maintenance,** to verify operation of the defibrillator to specifications. In addition, perform the defibrillator calibration and the defibrillator test in the built-in menu tests; see Chapter 2, **Installation and Configuration,** for test descriptions.

Test Equipment

The following test equipment is required to troubleshoot the defibrillator as described in this chapter. This equipment is all commercially available.

- A digital voltmeter such as the HP E2373A handheld multimeter.
- 12-lead ECG simulator.
- Pacer tester.
- Energy meter.
- Paddles ECG simulator (built into many manufacturers energy meter).

Safety Considerations

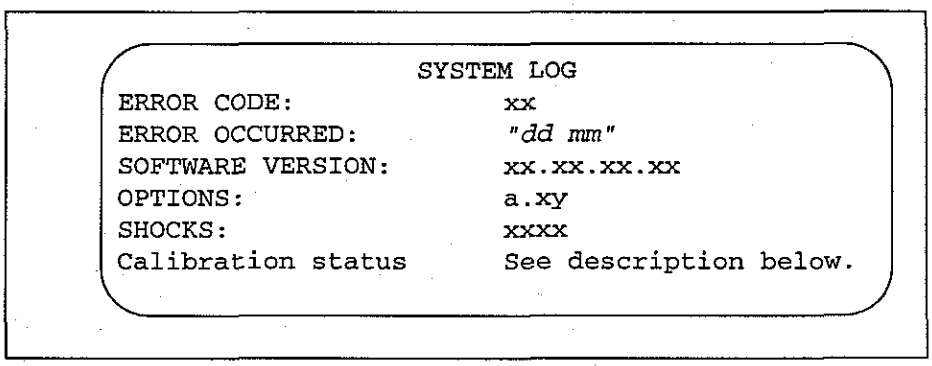
WARNING

- **To remove power from the instrument, you must turn the Energy Select control to *Off (Standby)*, unplug the instrument from AC power, and remove the battery. Disconnecting the unit from AC power will not remove power because the battery powers the instrument while AC power is unavailable.**
- **To disarm a charged instrument, there are three methods:**
  - **Turn the Energy Select control to the *Off (Standby)* position.**
  - **Place the paddles in their holders on the defibrillator, and depress both shock buttons on the paddles.**
  - **After 60 seconds, the unit automatically disarms.**
- **Before removing or inserting any board or connector, disconnect the instrument from AC power, and remove the battery.**
- **The defibrillator stores high voltage energy and is capable of delivering up to 360 joules of DC energy to a 50 ohm impedance.**

The System Log

The system log is battery-maintained memory that stores error codes for the last error event that the instrument detected. In addition, the system log contains software version and instrument option information. The system log can be printed by entering the setup/diagnostic menu and selecting PRINT LOG as explained in Chapter 3, **Performance Verification and Maintenance**. See Figure 5-1.

Figure 5-1



System (Error) Log Format

ERROR CODE:	The error code of a run-time error.
ERROR OCCURRED:	The date and time that the error occurred according to the system clock.
SOFTWARE VERSION:	The software version of the firmware installed in the defibrillator; the version line has the following format: Monitor code revision.Reserved.DSP code revision.Defib code revision.
OPTIONS:	A code in the form of: a.xy A = instrument, 0 = M1722A/B (XL+), 1 = M1723A/B (XL) For an XL, the second option number is always 0

X	Activate	where:
0	Nothing	A = EMS ECG
1	P.P.	AG = Auto Gain
2	FV	FV = Feature Vector
3	PP & Vector	PP = Pace Pulse
4	AG	
5	AG & PP	
6	AG & FV	
7	AG & FV & PP	
8	A	
9	A & PP	
A	A & FV	
B	A & FV & PP	
C	A & AG	
D	A & AG & PP	
E	A & AG & FV	
F	A & AG & FV & PP	

Y	Activate	where:
0	Nothing	P.Pr = Pacer Present
1	P.Pr.	SpO_2
2	SpO_2	
3	P.Pr. & SpO_2	

NOTE

These features are software revision dependent.

To activate these features, press the following keys in "Setup Menu 1".

Pace Pulse (SYNC) (HR Alarm) (Mark)

Feature Vector (SYNC) (Analyze)

To activate these features, press the following keys in "Setup Menu 2".

Auto Gain (SYNC) (HR Alarm)

EMS ECG (SYNC) (Mark)

SHOCKS: The number of shocks since the shock counter was last reset.

Calibration status: This area will contain one of these:

- `CALIBRATION PASSED` dd mmm yy—The last defibrillator calibration (on the date shown) was successful.
- `CALIBRATION FAILED` dd mmm yy —The last defibrillator calibration (on the date shown) failed; the defibrillator will still function but charge energy levels may not be accurate (the defibrillator will use a nominal value for the charge capacitor).
- `CALIBRATE DEFIB`—The defibrillator has not been calibrated or the calibration value has been lost. The defibrillator will still function but charge energy levels may not be accurate (the defibrillator will use a nominal value for the charge capacitor).

Error Codes

Table 5-1 describes the errors that can appear in the error log and suggests solutions. *Replace the board assemblies in the order shown; after replacing a board assembly, check to see if the problem has been resolved.* If the problem is still present, replace the next board assembly listed. When the instrument is working properly, clear the error log. See "Clearing the Error Log" on page 5-8 for detailed information. If more than one defibrillator error occurs, the codes for those errors are summed and printed in hexadecimal form. The hexadecimal sum of any combination of these error codes yields a unique number. For example, an error code of 0AC can only be formed by the sum of error codes 080, 020, 008, and 004.

Table 5-1 **Error Codes**

Error Code	Error Description	Possible Solution
001	The HV capacitor charges at less than 6 joules/second	1 Replace high voltage board. 2 Replace control board. 3 Replace HV capacitor.
002	The HV capacitor charges to more than 120% of the desired voltage.	1 Replace control board. 2 Replace high voltage board.
004	Unexpected drop in HV capacitor voltage.	1 Replace high voltage board. 2 Replace control board. 3 Replace HV capacitor.
008	Unexpected voltage on HV capacitor	1 Replace high voltage board. 2 Replace control board.
010	The safety relay has failed.	1 Replace high voltage board. 2 Replace control board.
020	The supply voltage is outside the nominal range.	1 Replace power supply. 2 Replace control board.
040	A patient relay drive failure was detected.	1 Check patient relay coil resistance. If outside nominal range, (3 ohms ± 1 ohm) replace patient relay. 2 Replace high voltage board. 3 Replace control board.
080	A power-on failure has occurred.	Replace control board.
100	Defibrillator control firmware failure has occurred.	1 Send error log and description of failure to the factory. 2 Cycle power. If problem persists, replace control board.
400	Patient relay drive redundancy failure	Replace H.V. board.
Monitor Codes:	1xxxx	For most monitor error codes, the cause is probably the control board.

Table 5-1 **Error Codes**

Error Code	Error Description	Possible Solution
10001	Monitor firmware failure has occurred.	1 Send error log and description of failure to the factory. 2 Cycle power. If problem recurs, replace control board.
10002	Defibrillator timeout (does not return shock information).	1 Send error log and description of failure to the factory. 2 Cycle power. If problem recurs, replace control board.
10003	Defibrillator timeout (does not accept configuration).	1 Send error log and description of failure to the factory. 2 Cycle power. If problem recurs, replace control board.
10004	Defibrillator timeout (does not accept ECG data).	1 Send error log and description of failure to the factory. 2 Cycle power. If problem recurs, replace control board. 3 Replace front end board.
10005	Clock timeout (Time-Out-Done clock is not ready).	Replace control board.
10006	Reserved	
10007	Reserved	
Front End Codes:	2xxxx	
20001	Sequential data error	Cycle power. If problem recurs, replace front end board.
20002	Total data error	1 Replace front end board. 2 Replace control board.
20003	DSP timeout (Back-up Timer interrupt).	Replace control board.
20004	Front end hard failure.	Replace front end board.
Pacer Codes:	3xxxx	
30001	Pacer failure.	1 Change pads and check pads adapter cable. 2 Cycle power on instrument. 3 Restart the pacer. If error reoccurs, 4 Replace pacer board. 5 Replace the control board.
SpO_2 Codes:	5xxxx	
50006	The SpO_2 sensor is broken.	Attach new sensor and cable.
50009	Unable to communicate with the dual-port RAM.	1 Cycle SpO_2 power. 2 Replace SpO_2 board.

Table 5-1 **Error Codes**

Error Code	Error Description	Possible Solution
5000A	Hardware failure on the SpO_2 module.	1 Cycle SpO_2 power. 1 Replace SpO_2 board.
5000B	The SpO_2 module processing units cannot communicate.	1 Cycle SpO_2 power. 1 Replace SpO_2 board.
5000D	Software problem in the SpO_2 module.	1 Cycle SpO_2 power. 1 Replace SpO_2 board.
5000E	The monitor cannot communicate with the SpO_2 module.	1 Cycle SpO_2 power. 1 Replace SpO_2 board.

If an error repeats, use the appropriate setup/diagnostic test to help locate the failure. The setup/diagnostic tests are described in Chapter 3, **Performance Verification and Maintenance**.

Clearing the Error Log

After servicing the defibrillator/monitor, it is important to reset (clear) the error log. This process clears the entries for "Error Code" and "Error Occurred".

To clear the error code from the error log, follow these steps:

1 Place the defibrillator in diagnostic mode.

2 On the setup/diagnostic menu, move the highlight bar over PRINT LOG.

3 Press the (Sync) and (HR Alarm) keys simultaneously.

Turn the Energy Select control to the **Off (Standby)** position, to exit the setup/diagnostic menu.

Troubleshooting Tables

The troubleshooting tables in this section help you to locate a fault and correct it. The following tables list errors and failure symptoms that can occur at power on, during normal operation, or as a result of setup/diagnostic tests. The tables define and explain the errors, and suggest one or more corrective actions for each.

The troubleshooting tables include the following:

Table 5-2	Describes tones made by the defibrillator.
Table 5-3	Explains system-level messages that the defibrillator can display.
Table 5-4	Describes displayed messages indicating defibrillator/monitor failures.
Table 5-5	Describes displayed messages that indicate pacer malfunction.
Table 5-6	Describes displayed messages that indicate a malfunction of the pulse oximeter.
Table 5-7	Describes failure messages that the recorder can print.
Table 5-8	Lists indications of improper use.
Table 5-9	Describes indications of power supply or main battery failures.
Table 5-10	Lists recorder problems and their symptoms.
Table 5-11	Lists symptoms display and logic failures.
Table 5-12	Describes keypanel failures and their symptoms.

Table 5-2 **Audible Indicators**

Tone	Cause	Possible Solutions
While all keypanel LEDs are lit, a beep about 1 second long.	At power-on, indicates power-on cycle is normal.	None required.
A continuous beep, about 7 seconds long.	At power-on, the monitor and defibrillator are not communicating.	The malfunction is probably in the monitor circuits; the defibrillator may still function properly. Replace the control board.
A repeating tone that alternates between two frequencies.	At any time, the instrument emits this tone beginning 1 minute before shutdown due to low battery charge. The battery voltage is less than 11.4 V The battery voltage is too low and the battery does not recharge.	Connect the instrument to AC power so that the battery can recharge. Check the battery cable connections to the high voltage board. Check the battery capacity by running the "Battery Capacity Test" on page 3-28.

NOTE

Other tones normally occur because various functions are enabled. See "Indicator Test" on page 3-26 for descriptions of these tones.

Table 5-5 **On-screen Pacer Messages (Option—XL+ only)**

Message	Cause	Possible Solutions
ATTACH PADS	Pads adapter cable is attached. (Charge) was pressed and pads are not attached. (Pacer On) was pressed and pads are not attached.	Attach the pacer pads.
NO PADS	Pacer is on and one of the following occurs: 1 No pads adapter attached. 2 Paddles attached. 3 Internal paddles attached.	Attach pads for pacing.
PACER FAILURE	Pacer cannot deliver the required current.	Troubleshoot pacer.
PADS OFF	Pads adapter cable is attached and a pad is off.	Attach pads for pacing.
STOP PACER	An attempt was made to change pacing mode while pacing.	Stop the pacer (press (Start/Stop)) before you change the pacing mode.

Table 5-6 **SpO_2 Messages (Option)**

Message	Cause	Possible Solutions
SPO2 FAIL-URE	The unit detected a failure in SpO_2 subsystem hardware. This failure does not affect other parts of the instrument.	Press (SpO_2 On/Off) twice to power cycle the SpO_2 option. If the error happens again, call for service.
SPO2 SEN-SOR FAIL	The sensor or adapter cable is broken.	Replace the sensor or adapter cable.
SPO2 CABLE OFF	Sensor or cable is disconnected.	Check SpO_2 connections between defibrillator/monitor and the sensor cable or adapter cable.
Dashes appear on display instead of SpO_2 reading.	Can't derive measurement because: • The sensor is not on the patient. • No pulse is detected. • The sensor is incorrectly positioned. • The sensor is defective.	Check the patient for a pulse. Reapply the sensor, and make sure it is correctly positioned. If it doesn't work, replace the sensor.
SPO2 NOISY SIGNAL	Irregular pulse patterns. Patient motion.	Reapply sensor. Consider using a different sensor site.

Table 5-6 **SpO_2 Messages (Option)**

Message	Cause	Possible Solutions
SPO2 LIGHT INTERF	Too much interference from external light. Damage to sensor or adapter cable.	Reapply sensor. Turn off lights in the room. If other options do not work, replace the sensor.
SPO2 LOW SIGNAL	Bad connection to patient, or patient has poor perfusion.	Check the patient for poor perfusion. Reapply disposable and semi-disposable sensors. Readjust reusable sensors. Consider using a different sensor site.

Table 5-7 **Printed Failure Messages**

Message	Possible Solutions
TEST 100J FAILED	Defib test failure: delivered energy check failed or the Shock Path Redundancy test failed. Print Error Log and troubleshoot per error code.

Table 5-8 **Operation Problems**

Symptom	Cause	Corrective Action
Noisy lead(s): Muscle artifact.	Patient is not relaxed or skin has been irritated.	Refer to user's guide.
	Low quality disposable electrodes, leadwire adapters.	Replace disposable electrodes or leadwire adapters.
	Defective leadwires.	Isolate defective leadwires and replace them.
	Noisy ECG amplifier	Test with ECG simulator. Use diagnostic test, "ECG Monitor Test" on page 3-18. Replace front end board.

Table 5-9 **Power Supply and Battery**

Symptom	Cause	Corrective Action
(AC POWER) indicator is not lit.	No AC power.	Check power cord, AC fuses on power supply board, and connectors.
	AC-on indication failed.	1 Replace power supply. 2 Replace control board.
	Power supply failed.	Replace power supply.
(BATT CHRG) indicator is not lit. ((AC POWER) indicator is lit.)	Battery is not installed.	Install the battery; check the connector.
	Battery sense circuit failed.	1 Replace high voltage board. 2 Replace control board.
Defibrillator will not power up on AC or battery power.	Power supply defective.	Replace power supply.
	Control board defective.	Replace control board.
Defibrillator will operate on AC but not battery power.	Battery fuse is blown.	Replace battery fuse on battery connector board.
	Battery voltage is too low.	1 Plug defibrillator into AC power to charge battery. 2 Perform battery capacity check. 3 Replace battery if the test fails.
Battery voltage is less than 11.4 volts.	Battery needs charge.	1 Plug defibrillator into AC power to charge battery. 2 Perform battery capacity check. 3 Replace battery if the test fails.
Battery will not accept charge.	Battery is defective.	Replace battery.
	Battery charger failed.	Replace power supply.

NOTE

The diagnostic screen, TEST BATTERY, will provide the following information:

`NO BATTERY`	Appears if the battery is not installed, or if the unit does recognize that the battery is installed.
`DISCONNECT AC POWER`	Appears if the unit recognizes AC power is connected.

Table 5-10 Recorder Problems

Symptom	Cause	Corrective Action
Paper doesn't move.	Paper out or jammed.	Replace paper or clear paper jam.
	Defective sensor.	Replace recorder board or recorder assembly.
	Defective drive assembly.	Replace drive assembly or recorder assembly.
	Defective drive signals.	Replace Control Board.
	Dirty sensor lens.	Clean sensor lens.
	Defective communication between recorder board and motor.	Check motor to recorder board cable connector.
Paper moves, then stops.	Paper loaded incorrectly.	Make sure defibrillator is loaded properly with approved thermal paper.
	Dirty sensor lens.	Clean sensor lens.
	Defective sensor.	Replace recorder board.
	Defective sensor circuit.	Replace control board.
Wavy diagonal lines in recorder self-test or distortion of print-outs in the time axis.	Improper meshing of gears in drive assembly or door assembly.	Replace recorder drive assembly or door assembly. Replace control board.
	Defective communication between recorder and control board.	Replace control board.
Message: CHECK RECORDER	Door is ajar.	Close door.
	Paper installed incorrectly.	Re-install paper.
	Dirty sensor lens.	Clean sensor lens.
	Defective communication between recorder and control board.	Check cables and connections between recorder and control board.
		Replace recorder assembly.
		Replace control board.
	Defective sensor assembly.	Replace recorder board.

Table 5-10 Recorder Problems

Paper moves but printing is faint or absent.	Door improperly latched.	Check door latch.
	Paper loaded incorrectly, or non-approved or non-thermal paper installed.	Make sure defibrillator is properly loaded with approved thermal paper.
	Insufficient leaf spring tension or printhead out of position.	Check leaf spring on printhead for platen pressure.
	Defective printhead or printhead cables.	Check printhead cable connector. Replace printhead.
	Defective recorder board cable connector or component in recorder interface circuitry.	Check the recorder board cable connector. Replace control board.
Printed data is garbled.	Defective printhead.	Replace printhead or recorder assembly.
	Defective component in data path.	Check printhead cables. Replace control board.
Poor print quality or some dots not printing.	Dirty printhead.	Clean printhead.
	Defective printhead or printhead cables.	Check printhead cable connector or replace printhead.
	Defective component in recorder circuitry.	Replace recorder assembly.
Some dots always on.	Defective printhead.	Replace printhead or recorder assembly.

Table 5-11 Display and Logic

Symptom	Cause	Corrective Action
Display too dim or too bright.	Improper brightness adjustment.	Adjust brightness controls for best display appearance. See CRT adjustment procedure.
No brightness adjust.	Defective display assembly	Replace display assembly.
All dark screen.	Contrast or brightness misadjusted.	Adjust contrast.
	Deflection circuits failed or video circuits failed.	1. Replace display board. 2. Replace control board.

Table 5-12 Panel Keys

Symptom	Cause	Corrective Action
Keys won't work.	Keypanel board cable unplugged or defective.	Reconnect or replace cable.
	Keypanel circuit board defective.	Replace keypanel board or assembly.
	control board defective.	Replace control board

Table 5-13 Defibrillator Problems

Symptom	Cause	Corrective Action
No response to (Charge) key.	Paddles cable not installed.	Install cable.
	Lockout Error (DEFIB FAILURE)	For error code, perform, PRINT LOG in Diagnostic screen. Replace control board, high voltage board, or high voltage components as recommended in Table 6-1.
	(Charge) key not recognized.	Run Controls Test to check for recognition of (Charge) key. Replace paddles, front panel, control board as needed.
Delivered Energy out of specification.	Improper defibrillator calibration.	Perform diagnostic test CALIBRATE DEFIB.
	Defective High Voltage Board.	Replace high voltage board.
	Defective control board.	Replace control board.
	Defective HV capacitor	Replace HV capacitor.
Test Discharge indicates a failure, external defibrillator test passes.	Internal delivered energy out of calibration.	Calibrate the Peak Current Measurement circuitry as described in "Adjusting the Internal Delivered Energy Calibration" on page 6-33.
	Defective Control Board.	Replace Control Board.
DEFIB FAILURE At power up or after a discharge.	Patient relay or drive circuit failure (Error 40 or 440). See warning below.	Replace patient relay. Replace high voltage board.
	Unexpected voltage on HV capacitor.	Replace HV board.
Unit does not deliver energy, no failure message occurs.	Patient Relay failure.	Replace Patient Relay.

WARNING

The high voltage storage capacitor can store lethal amounts of energy. Be sure that this capacitor is discharged before touching high voltage components, such as the high voltage capacitor, patient inductor, patient relay, or patient cable connector. To discharge the high voltage capacitor:

1. **Be sure to wear safety glasses while discharging the capacitor.**
2. **In diagnostic mode make sure that the Available Energy is 0 (the Energy Select control is in the Monitor--On position).**
3. **Turn the Energy Select control to Off (Standby).**
4. **Wait 30 seconds before opening the unit.**
5. **After accessing the chassis as described in step 1 below, short the terminals of the high voltage capacitor using a tool with HP part number M1722-87912.**

If you do not have the tool with HP part number M1722-87912, wait one hour before servicing the unit. You can then proceed using a screwdriver with an insulated handle to short the capacitor terminals.

Table 5-14 **Pacer Problems**

Symptom	Cause	Corrective Action
QRS not detectrd	QRS is not in specs	These specs are: QRS amplitude: 0.5 mV - 5.0 mV RS width: 40 mSec - 120 mSec
	Pacer is in Fix Mode	Change pacer to Demand Mode
Heart is not captured	Output current is too low	Increase output current until heart is captured. This occurs between 50 mA - 200 mA.
	Pacer HR is below instransic HR	Adjust Pacer HR at desired value
	Misplacement of pads	Reposition the pads

Testing the Power Supply

Use this procedure to check the voltages produced by the power supply. All the voltage measurements are made on the control board, connector J12, and are taken with respect to ground.

WARNING

When the defibrillator is connected to AC power, there are dangerous voltages on the line module terminals. Do not touch any of the exposed connectors.

The HV capacitor stores hazardous amounts of energy during AC and battery operation. Be careful not to touch any of the exposed capacitor connections.

Make measurements on battery only. Plug into AC power only if the battery is too low to operate the defibrillator.

1 Remove the top cover as described in Chapter 6, **Removal and Replacement**

CAUTION

Be very careful not to short test points to ground or to other pins. This can result in defibrillator/monitor failure.

2 Locate connector J12 on the control board.

3 Check that the voltage at pin 27 is +4.3V ±0.4V.

4 Check that the voltage at pin 29 is +5.1V ±0.25V.

5 Check that the voltage at pin 31 is +12V ±0.6V. The presence of these voltages confirm the proper operation of the power supply.

6 Re-install the top cover.

7 Check AC/DC converter/ battery charger in the following steps:

a. Remove the battery from the instrument.
b. Connect AC power.
c. From the diagnostic menu, run the TEST BATTERY test.
d. Observe VDC on the test screen by reading the voltage from the line labelled VOLTAGE NOW.
e. Check that VDC = 13.6 V ±0.6 V.

NOTE

This measurement must be made at room temperature (20°C to 25°C). VDC is the battery charge voltage (float voltage), and is temperature compensated. This measurement must be made with the battery removed as VDC is set by the condition of the battery.

Removal and Replacement

Introduction

This chapter provides procedures for removing and replacing these defibrillator assemblies:

- The battery
- The recorder
- The keypanel assembly
- The pacer keypad assembly
- The CRT assembly and SpO_2 board
- The pacer board
- The control board
- The power supply assembly
- The high voltage charger and relay assembly
- The high voltage capacitor
- The patient inductor
- The ECG front end board
- Replacing the lithium battery
- Replacing fuses

This chapter also provides procedures for adjusting the CRT after maintenance.

WARNING

Dangerous voltages may be present on components and connections during instrument disassembly. Use extreme caution while the instrument cover is removed.

NOTE

The way that wires and cables are routed and dressed inside the chassis plays an important part in reducing electromagnetic and radio frequency interference emitted by the defibrillator. When you disassemble any part of the defibrillator, pay special attention to how cables and wires are routed. When you reassemble the defibrillator, be sure to route and dress all cables and wires as they were originally.

Tool Requirements

You will need the following tools to perform the procedures given.

- ❑ T10 and T15 drivers (or Torx driver kit, HP part no. 5181-1933)
- ❑ 5/16" nutdriver
- ❑ insulated flat-tip screwdriver
- ❑ long-nose pliers with insulated handles (for discharging the CRT)
- ❑ Small ruler with a centimeter scale (for CRT adjustments)
- ❑ CRT adjustment tool, HP part number 8710-1355

CAUTION

Be sure to work in a static free environment. Use an electrostatic wrist band. The work surface and area surrounding it must be static free.

Removing the Battery

Perform the following procedure to remove the battery.

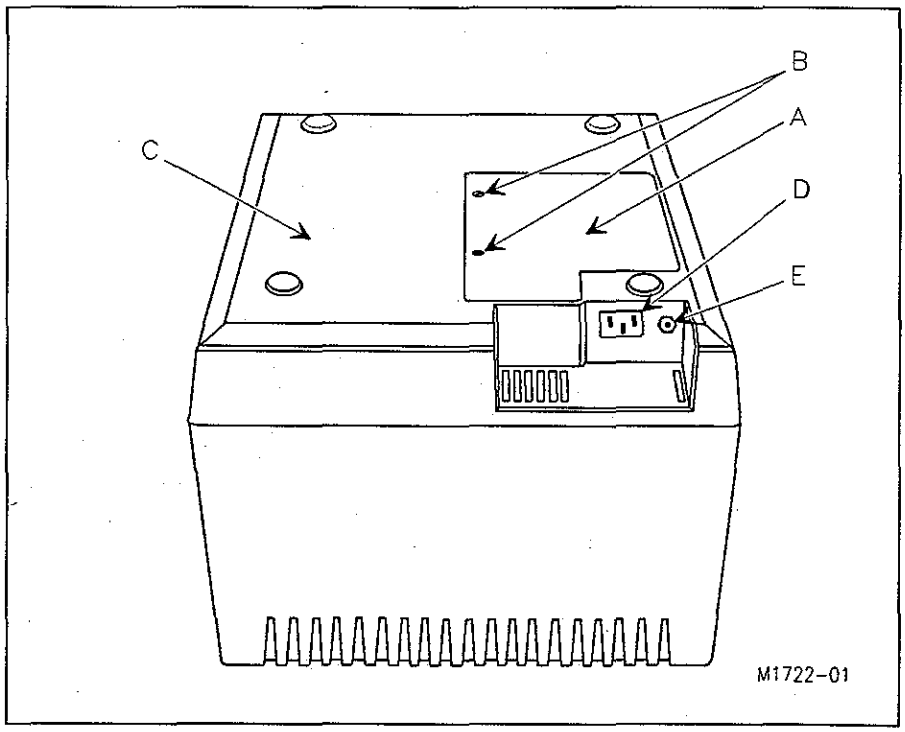
WARNING **To avoid electrical shock hazard, unplug the power cord from the AC outlet now.**

1 Turn off the instrument.

2 Turn the defibrillator upside down on the workbench. The battery compartment door is located in the bottom of the unit. Using a flat-tip screwdriver, turn the two screws 1/4-turn counter-clockwise to release the door. See Figure 6-1.

3 Disconnect the battery cable and lift the battery from the unit.

Figure 6-1



Accessing the Battery

A. Battery compartment door.
B. Retaining screws ($\frac{1}{4}$ turn).
C. Bottom side of defibrillator.
D. AC power receptacle.
E. Equipotential connector.

Opening the Defibrillator Chassis

Perform the following procedure to open the defibrillator chassis.

WARNING

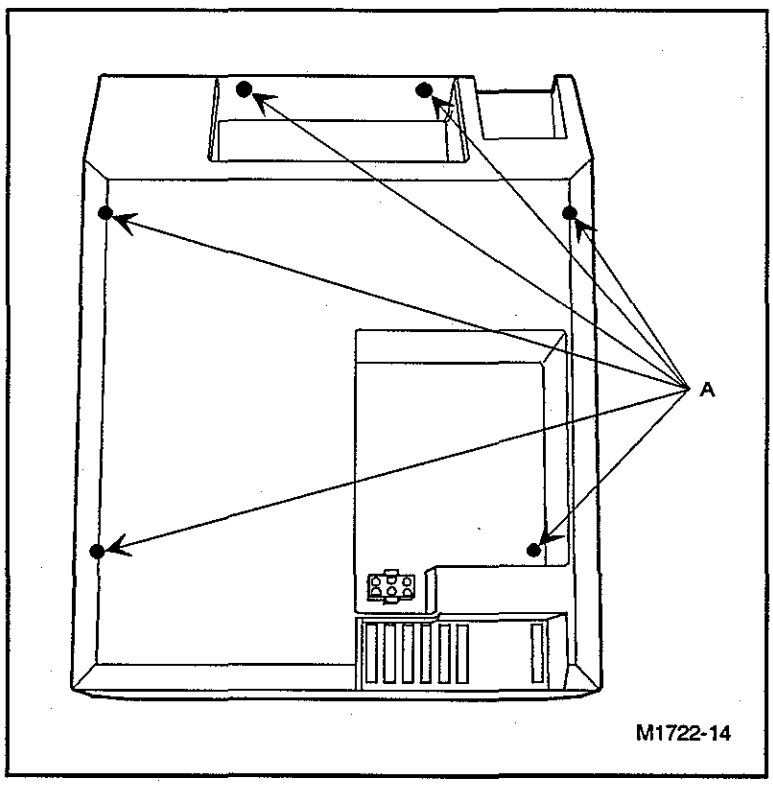
Before disassembly, check the defibrillator charge. Using the "Defibrillator Test" on page 3-14, verify that the available energy is zero.

1 Remove the paddles and the paddles connector.

2 Perform the procedure "Removing the Battery".

3 Using a Torx T-15 screwdriver, remove the six screws that secure the upper and lower parts of the chassis. See Figure 6-2.

Figure 6-2



Opening the Defibrillator Chassis

A. Location of chassis screws

4 Turn the chassis upright. This will cause the six screws to fall out of the chassis. Perform this step slowly to avoid losing the screws. Grasp the handle securely and slowly tilt the chassis onto its back, and then onto its feet. Collect the screws and save for reassembly.

CAUTION

Be careful when opening the top cover; ribbon cables and ground wires connect the top and bottom parts of the chassis.

5 While facing the front of the instrument, partially open the top-right of the chassis. If the instrument is equipped with the pacer option, disconnect the cable assembly attached to the right-most connector on the control board, just beneath the CRT. Open the chassis top to the left. Rest the chassis top on its side to avoid stressing cables.

6 At the control board, disconnect the ribbon cable that runs from J2 on the control board and the recorder. Also disconnect the ribbon cable that runs from J6 on the control board and the keypanel assembly. Make a note of where these cables connect.

7 If the SpO_2 option is present, at the SpO_2 board on the left side of the CRT, disconnect the cable from the SpO_2 board to the keypanel control board.

8 At the front end board, disconnect the black wire that runs from the top cover to the BLK LOAD RES connector on the front end board. You can now separate the chassis top and bottom.

Removing the Recorder

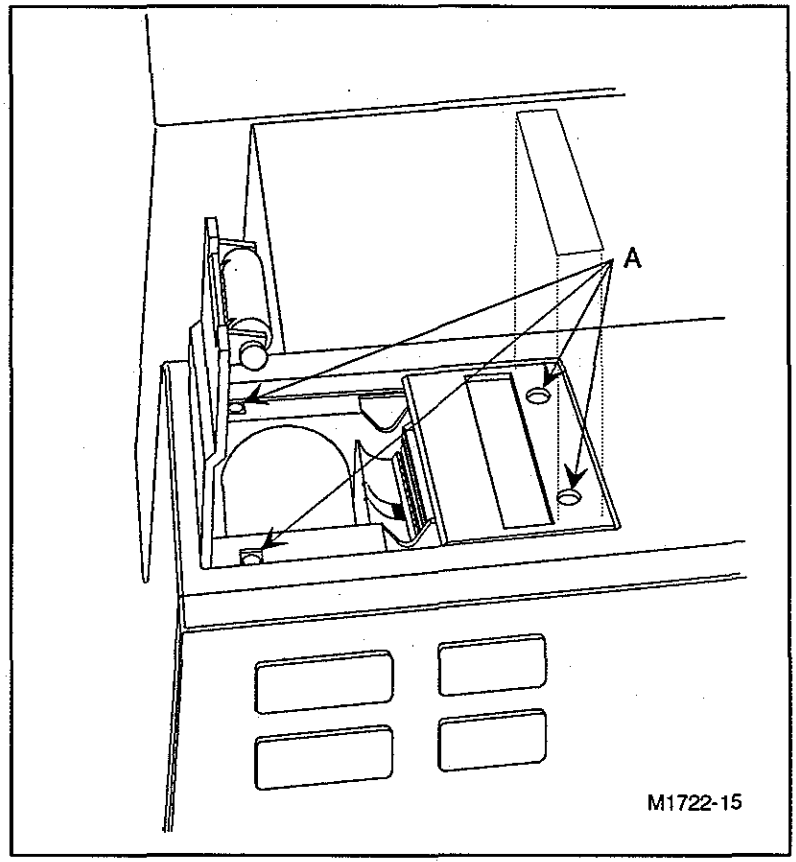
To replace any of the components on the recorder, you must first remove the recorder from the defibrillator chassis. This procedure also includes instructions for removing the recorder sliding door. The recorder can be removed without opening the defibrillator chassis. Perform the following steps.

1 At the recorder, remove and save the plastic label that covers the two screw holes. See Figure 6-3.

2 Using a Torx T-10 screwdriver, remove the four screws that secure the recorder to the chassis. Lift the recorder from the recorder bucket and disconnect the ribbon cable. Do not push down in the recorder bucket; this may cause it to drop into the chassis. Perform this procedure in reverse to install the recorder.

   To remove the recorder sliding door, perform step 3.

Figure 6-3



Removing the Recorder

A. Recorder retaining screws, under open door on left and under plastic label on right

3 To remove the recorder sliding door, turn the recorder upside down, so that the sliding door is facing you and the paper roll is facing away. Note how the springs are installed on the sliding door and how the metal door limit is used to stop the travel of the sliding recorder door. (The springs are identical.)

4 Using a pair of needle-nose pliers, remove and save both springs.

5 Lift the door travel limiter up and slide the door forward, away from the recorder. Now bend the retaining clips on the door so that the door is free of the recorder. To reinstall the sliding door, perform these steps in reverse.

After removing the recorder, you can remove the recorder bucket by opening the chassis and pushing down on the recorder bucket from the top.

Removing the Recorder Platen Assembly

Perform the following procedures and steps to remove the Recorder Platen Assembly.

1 Perform the procedure "Removing the Recorder".

2 Open the platen assembly so that the print head is visible.

3 Grasp the body of the recorder with the right hand and squeeze the body so that the hinge pins move in. When the hinge pins disengage from the platen assembly, lift the platen assembly from the hinges.

4 To install a new platen assembly, perform this procedure in reverse order.

Removing and Disassembling the Keypanel Assembly

To remove the keypanel assembly, you need to open the chassis and first remove the recorder and the recorder bucket. Perform the following procedures and steps.

1 Perform the procedure "Removing the Recorder". This procedure includes references to opening the chassis.

2 The chassis should be open. Three clips located in the top cover secure the keypad assembly into place. Use a flat-tip screwdriver to unhook the clips and remove the keypad assembly.

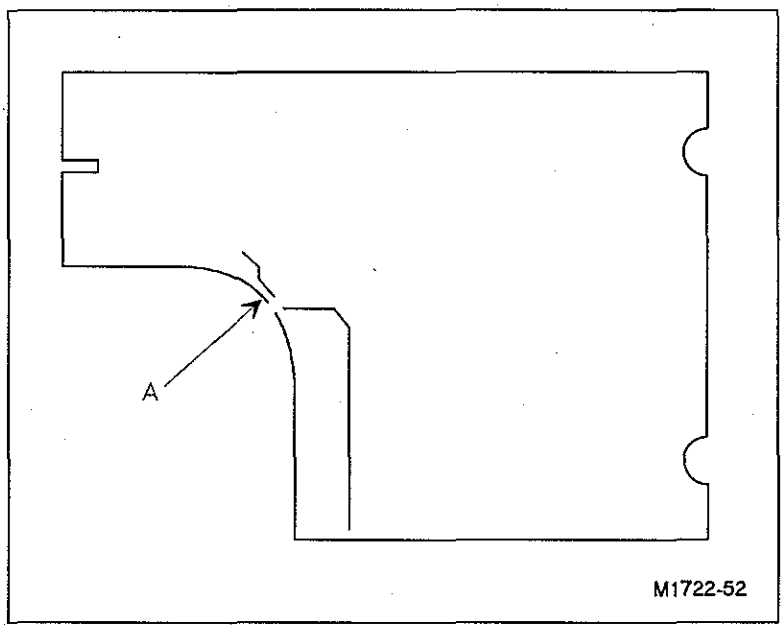
3 The keypanel circuit board, keypad, plastic lens, bezel and keylabel are all secured with two Torx T-10 screws. Remove these screws to disassemble the keypanel assembly.

4 To replace the keypanel circuit board, first disconnect the flexible circuit cable that connects the circuit board to the Energy Control knob. Use a small, flat-tip screwdriver to unhook the connector. Then separate the rubber keypad from the circuit board.

5 When installing a new keypanel circuit board, you need to configure the circuit board for use with the correct defibrillator model. If you are installing the circuit board in a model M1722A/B defibrillator/monitor, leave the circuit board unchanged and install it in the unit. If you are installing the circuit board in a M1723A/B defibrillator/monitor, you will need to modify the circuit board. See Figure 6-4. On the back side of the circuit board is a small hole, with circuit etch running along the edge of the board. To configure the circuit board for use in a M1723A/B, cut the circuit etch with a pair of diagonal cutters. Then install the circuit board in the unit.

To assemble and install the keypanel assembly, perform the previous procedure in reverse order.

Figure 6-4



Configuring the Keypanel Circuit Board

A. Cut trace here to configure for a model M1723A/B.

Removing the Pacer Keypad Assembly

The pacer keypad assembly consists of a small circuit board and the rubber keypad. Perform the following procedures and steps.

1 Perform the procedures "Removing the Battery" and "Opening the Defibrillator Chassis".

2 Disconnect the cable running between the control board and the keypad assembly.

3 Remove the four screws that secure the keypad assembly. Use a T10 screwdriver.

To install the pacer keypad assembly, perform the procedure "Removing the Pacer Keypad Assembly" in reverse order.

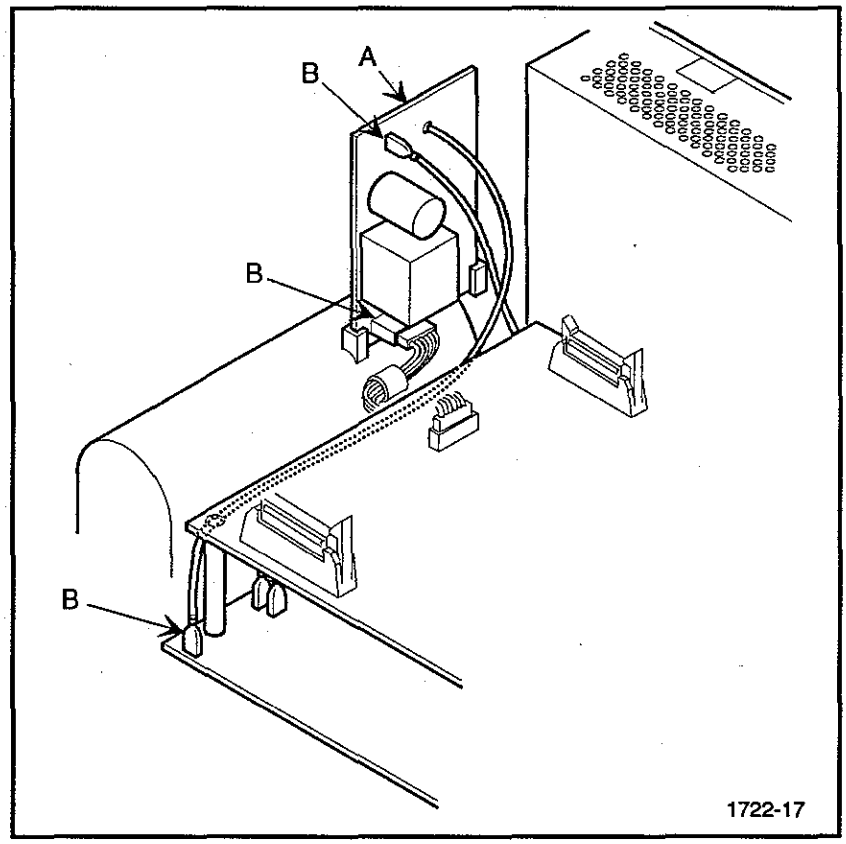
Removing the Pacer Board

The pacer function is an option to the M1722A/B. Perform the following procedure to remove the pacer board.

1 Perform the procedures "Removing the Battery" and "Opening the Defibrillator Chassis".

2 The pacer board is located to the left-rear of the chassis. This board is positioned vertically, above the high voltage capacitor. At the pacer board, disconnect the seven-pin cable assembly that runs between the pacer board and the control board (J7). See Figure 6-5.

Figure 6-5



Removing the Pacer Board

A. Pacer board
B. Disconnect these cables

3 Disconnect the red wire that runs from the patient relay (under the control board) to the jack on the pacer board. Label this wire. Plastic extrusions located on top of the high voltage capacitor case are available for stowing this wire when the pacer board is not installed.

4 Disconnect the white wire that runs from the pacer board to the WHT PACER jack on the ECG front end board.

5 The pacer board is not secured into place using screws. Gently pull the pacer board up to remove it.

To install the pacer board, perform the procedure "Removing the Pacer Board" in reverse order.

Removing the Power Supply Assembly

To remove the power supply assembly, perform the following procedures and steps.

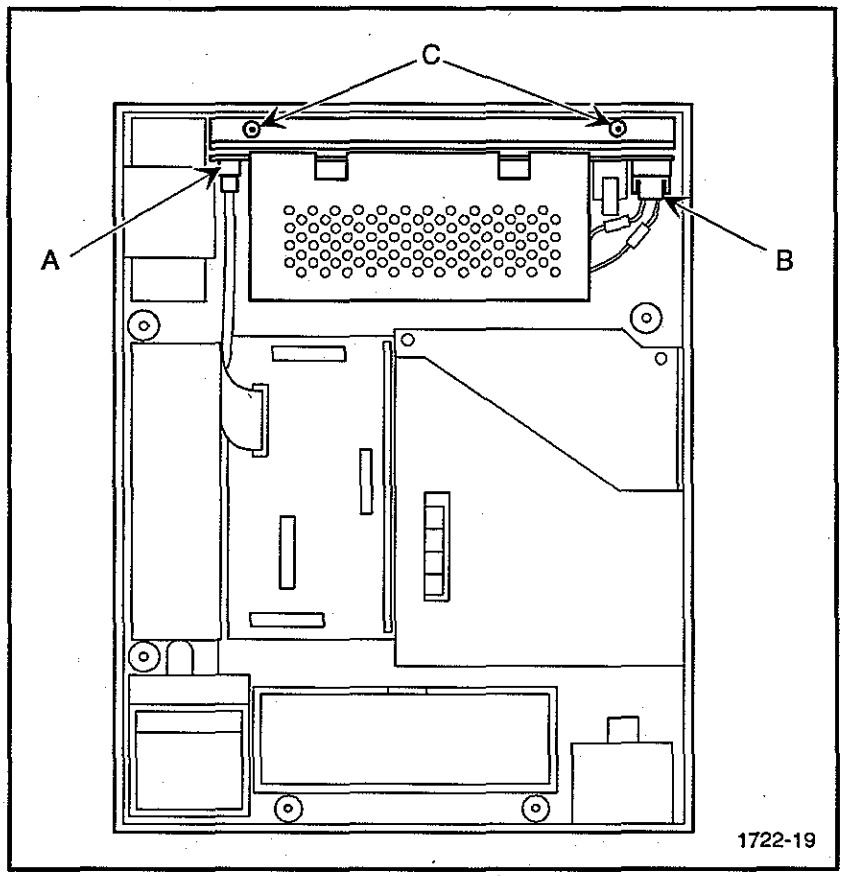
1 Perform the procedures "Removing the Battery" and "Opening the Defibrillator Chassis".

2 The power supply assembly is positioned vertically, at the back of the chassis. Disconnect the AC input cable at the right of the power supply assembly. See Figure 6-6. (In Figure 6-6, the CRT assembly is shown removed for purposes of clarity only.)

3 At the power supply assembly, on the left, disconnect the flat ribbon cable that runs to the control board and to the high voltage charger board. Using a Torx T-15 screwdriver, remove the two screws that secure the power supply assembly to the chassis. They are located on the back side of the supply.

To install the power supply assembly, perform the procedure "Removing the Power Supply Assembly" in reverse order.

Figure 6-6



Removing the Power Supply Board

A. Ribbon cable; disconnect at power supply
B. AC input cable
C. Retaining screws, behind supply

Removing the CRT Assembly and SpO_2 Board

To remove the CRT assembly, perform the following procedures and steps.

WARNING

Be sure to wear safety glasses while performing the following step. Accidental implosion of the CRT can cause injury.

1 Perform the procedures "Removing the Battery" and "Opening the Defibrillator Chassis".

2 Perform the procedure "Removing the Power Supply Assembly".

WARNING

High voltages are present at the CRT anode. Use only insulated tools when performing the following step. Do not touch the metal face band of the CRT while performing the following step.

3 At the control board, disconnect the 10-conductor ribbon cable that runs between the control board and the CRT deflection board.

4 If the SpO_2 option is present, disconnect the ribbon cable from J12 on the control board. Disconnect the SpO_2 input cable from the SpO_2 board.

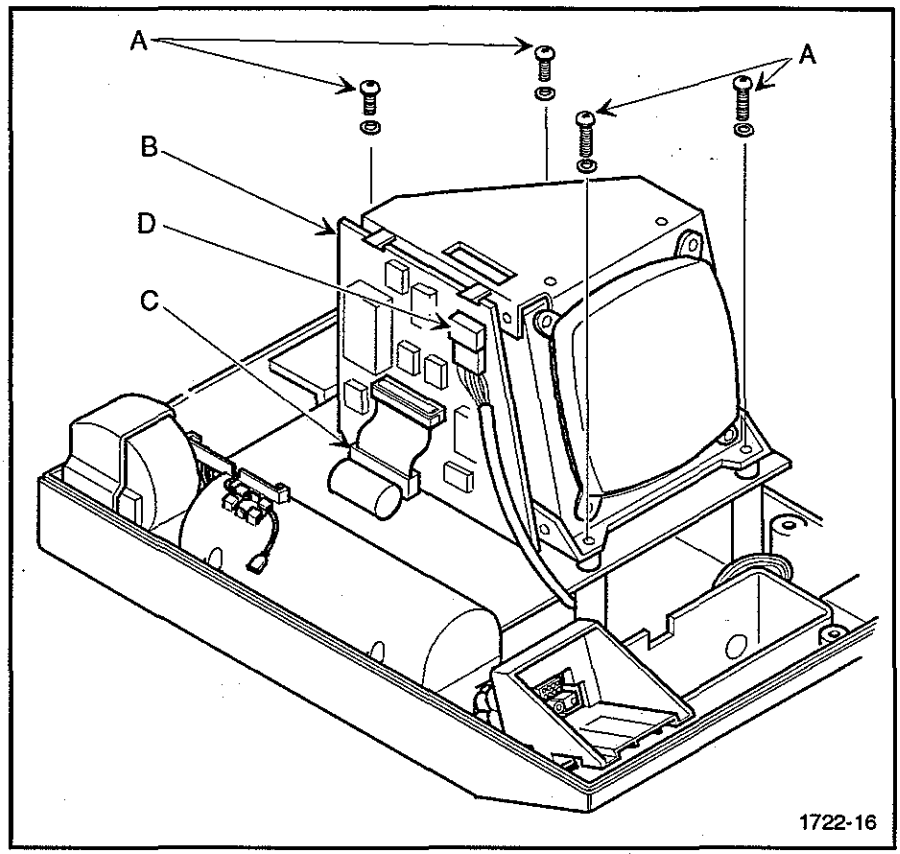
5 Using a Torx T15 screwdriver, loosen the four screws that secure the CRT assembly to the chassis. See Figure 6-7. Leave the screws in the CRT assembly, to keep them falling into the chassis. Lift the CRT assembly off the chassis and save the screws. Save the spacers beneath the CRT assembly and prevent them from falling into the chassis.

To remove the SpO_2 board:

1 Unsnap the SpO_2 board from the four tie locks near the upper and lower edges of the board.

2 If the mylar insulator beneath the board is damaged, you can remove it by cutting the tie locks off of the CRT assembly.

Figure 6-7



Removing the CRT Assembly

A. CRT assembly retaining screws

B. SpO_2 board

C. SpO_2 ribbon cable

D. SpO_2 input connector

To further disassemble the CRT assembly, perform the following steps.

1 Using insulated long-nose pliers, carefully lift the plastic collar away from the high voltage connection on the side of the CRT. Slide an insulated flat-tip screwdriver under the collar and discharge the CRT anode against the metal CRT assembly.

2 To remove the CRT itself from the assembly, remove the high voltage connection from the side of the CRT. Carefully remove the cathode connection from the end of the CRT.

3 At the deflection board, disconnect the five-wire CRT deflection connector. The CRT is now free of the assembly.

4 Remove the small connector board at the back of the CRT.

5 Using a Torx T-15 screwdriver, remove the four screws that secure the CRT to the CRT assembly. Slide the CRT forward, away from the assembly.

6 To remove the deflection board, remove the single screw that secures the deflection board to the CRT assembly. A ground wire is tied to this screw. Slide the deflection board from the yoke assembly out from the CRT assembly.

To replace the SpO_2 mylar insulator, position a new sheet over the holes in the CRT assembly. Using a $\frac{3}{16}$" nut driver, snap new tie locks into the CRT holes. Line up the holes on the SpO_2 board with the tie locks, and snap the SpO_2 board into the tie locks without flexing the board.

To install the deflection board, the CRT and the CRT assembly, perform the above procedure in reverse order.

Removing the Control Board

To remove the control board, perform the following procedures and steps.

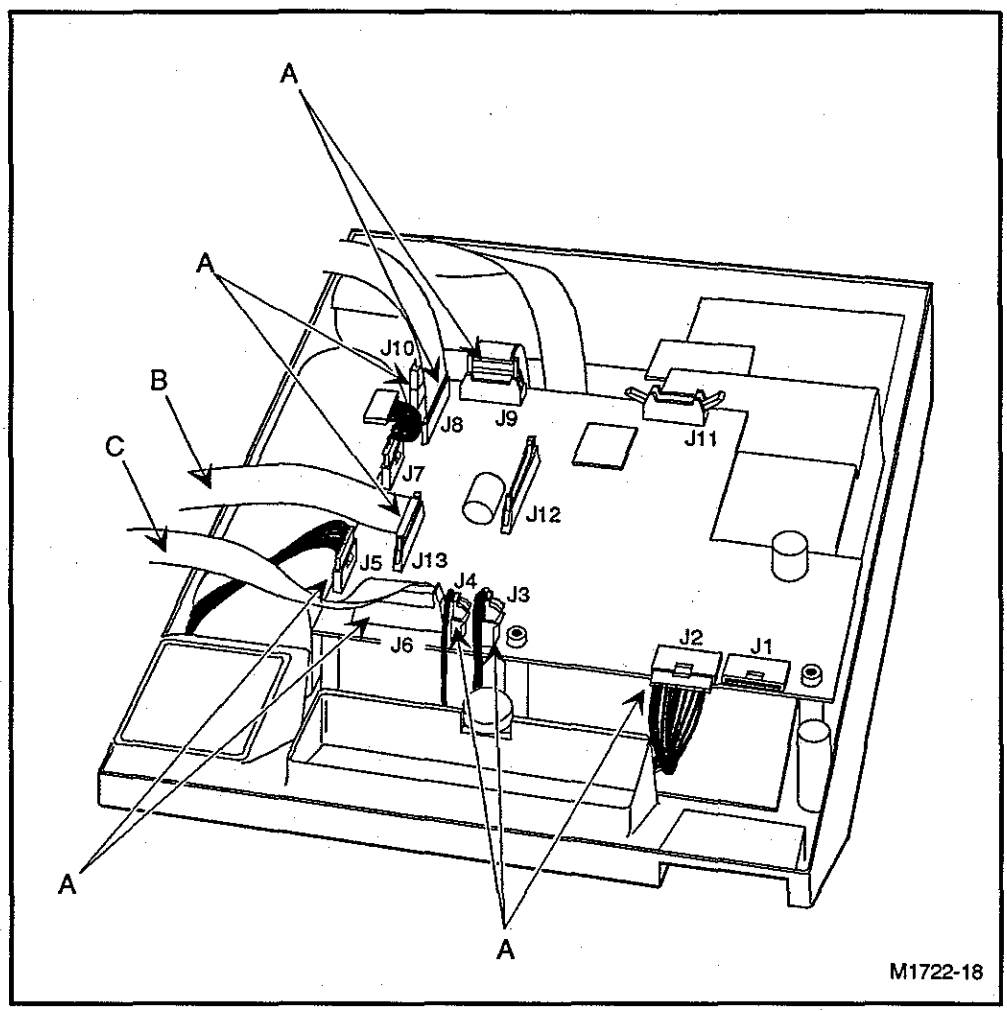
1 Perform the procedure "Removing the Pacer Board".

2 Perform the procedure "Removing the Power Supply Assembly".

3 Perform the procedure "Removing the CRT Assembly and SpO_2 Board".

4 At the control board, disconnect all remaining cables. Connectors are J1 through J13. Save the loose cable that connects to J11. J12 connects to the SpO_2 option cable. Figure 6-8 shows the locations of the cables and connectors.

Figure 6-8



Removing the Control Board Cables and Connectors

A. Cables and connectors to remove
B. This cable connects to the recorder
C. This cable connects to the keypanel assembly

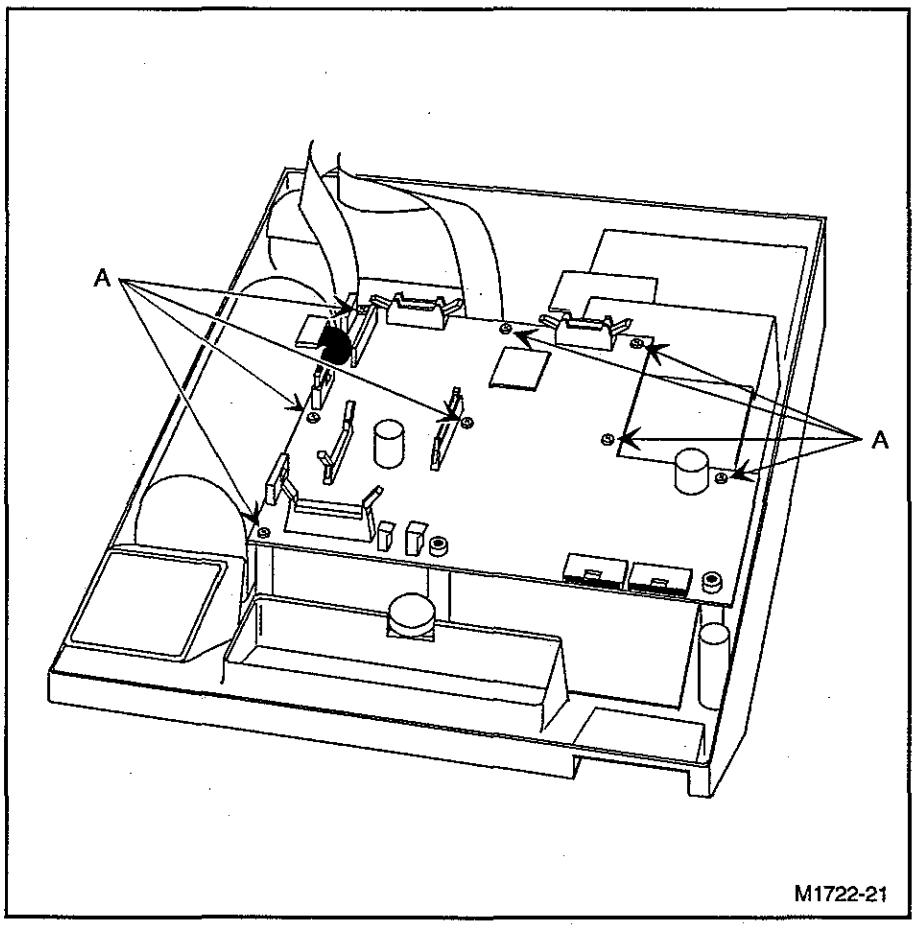
CAUTION

To avoid shorting the lithium battery, do not place the control board on a conductive surface.

5 Using the Torx T-10 screwdriver, remove the screws that secure the control board to the chassis. Figure 6-9 shows the locations of the retaining screws. Remove the control board from the chassis and place it on a non-conductive surface. This will avoid shorting the terminals on the lithium battery.

To install the control board, perform the procedure "Removing the Control Board" in reverse order. Calibrate the peak current measurement circuitry using the procedure "Adjusting the Internal Delivered Energy Calibration" on page 6-33.

Figure 6-9



Removing the Control Board

A. Control board retaining screws

Removing the ECG Front End Board

To remove the ECG front end board, perform the following procedures and steps.

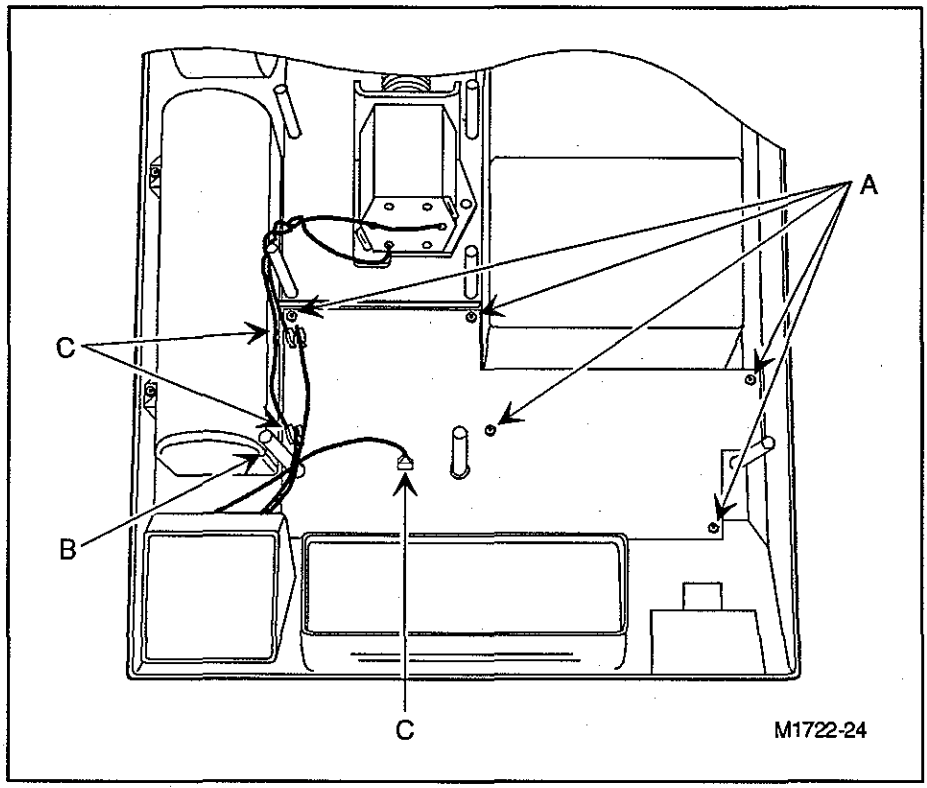
1 Perform the procedures "Removing the Battery" and "Opening the Defibrillator Chassis".

2 Perform the procedure "Removing the Control Board". This procedure instructs you to access the chassis and also remove the pacer board, power supply, CRT assembly and control board.

3 At the ECG front end board, two red wires attach to the RED STERNUM connector. One wire runs to the patient cables connector. The other wire runs to the patient relay. Disconnect both wires. See Figure 6-10.

4 At the front end board, two white wires attach to the WHT APEX connector. One wire runs to the patient cables connector. The other wire runs to the patient relay. Disconnect both wires.

Figure 6-10



Removing the ECG Front End Board

A. Retaining screws
B. Plastic standoff
C. Cables and connectors

5 Disconnect the 7-conductor cable assembly that runs between the ECG input connector and the flat 7-pin connector on the front end board.

6 Using a Torx T-10 screwdriver, remove the QRS beeper volume control potentiometer. This is located on the front of the chassis. Squeeze the plastic ears to remove the ECG input connector from the front of the instrument. The connector and cable will pull out to the front of the machine.

7 Using a pair of pliers, remove the ECG output connector. This is located on the front of the chassis.

8 Using a 5/16" nut driver, remove the plastic standoff that supports the control board.

9 Using a Torx T-10 screwdriver, remove the five screws that secure the front end board to the chassis. You can now remove the front end board.

To install the front end board, perform the procedure "Removing the ECG Front End Board" in reverse. Make sure that the correct wires are connected to the proper connector. Check wire colors using Figure 6-13 and Figure 6-14.

Removing the High Voltage Charger and Relay Assembly

This procedure includes removing the patient relay and the high voltage charger board. The high voltage charger and relay assembly consists of the high voltage charger board, the patient relay, high voltage capacitor and patient inductor. This assembly is located under the control board, at the left-rear corner of the instrument. Perform the following procedures and steps to remove the assembly.

WARNING

The high voltage storage capacitor can store lethal amounts of energy. Be sure that this capacitor is discharged before touching high voltage components, such as the high voltage capacitor, patient inductor, patient relay, or patient cable connector. To discharge the high voltage capacitor:

1 **Be sure to wear safety glasses while discharging the capacitor.**

2 **In diagnostic mode make sure that the Available Energy is 0 (the Energy Select control is in the Monitor--On position).**

3 **Turn the Energy Select control to Off (Standby).**

4 **Wait 30 seconds before opening the unit.**

5 **After accessing the chassis as described in step 1 below, short the terminals of the high voltage capacitor using a tool with HP part number M1722-87912.**

If you do not have the tool with HP part number M1722-87912, wait one hour before servicing the unit. You can then proceed using a screwdriver with an insulated handle to short the capacitor terminals.

1 Perform the procedures "Removing the Battery" and "Opening the Defibrillator Chassis".

2 Perform the procedure "Removing the Power Supply Assembly".

3 Perform the procedure "Removing the Control Board". This procedure instructs you to open the chassis and also remove the CRT assembly and the pacer board.

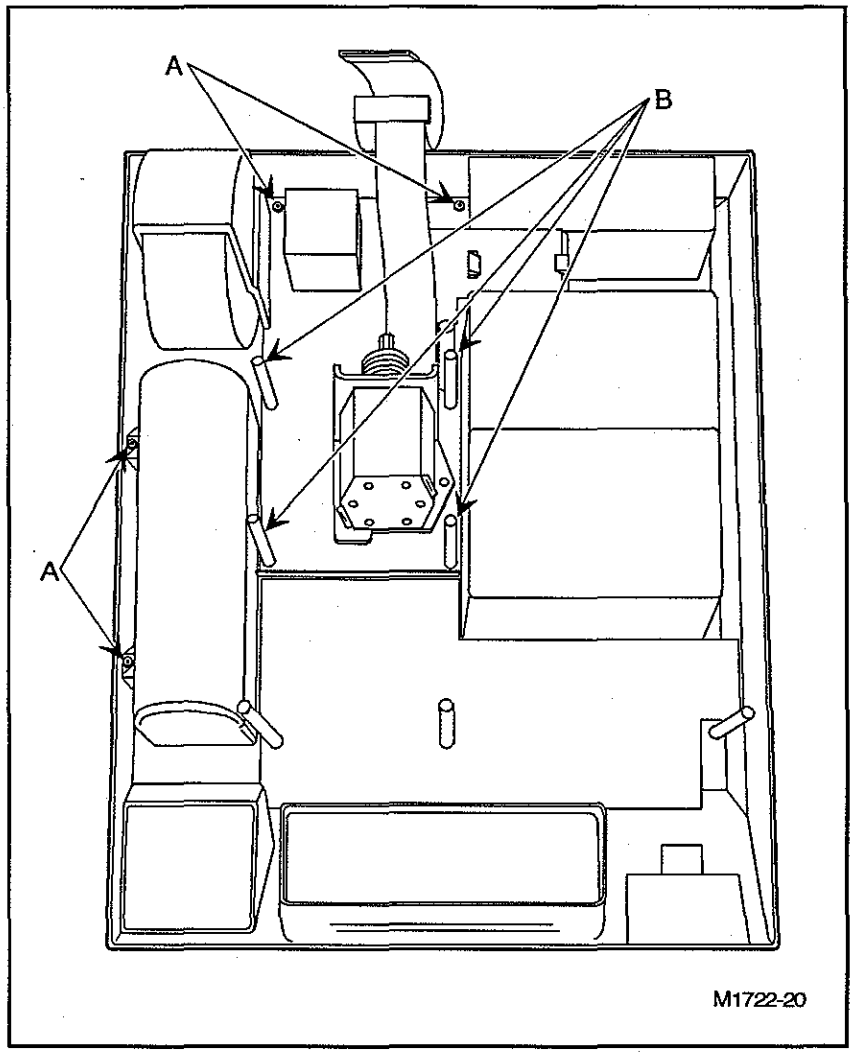
4 The battery connector board is positioned beneath the power supply and is attached to the high voltage charger assembly with soldered wires. To remove

the battery connector board, first remove the black rubber plug and then release the latch that secures the board in place. See Figure 6-11. When reinstalling the battery connector board, be sure that the alignment pin on the chassis bottom is centered in the hole on the board.

5 Using the Torx T-10 screwdriver, remove screws that fasten the high voltage charger and relay assembly to the chassis. See Figure 6-11. Two screws are located on the high voltage charger board and two screws are located on the high voltage capacitor case.

6 Disconnect the patient relay wires that connect the front end board. Be certain to label each wire.

Figure 6-11



Removing the High Voltage Charger and Relay Assembly

A. Retaining screws
B. Standoffs

7 Four vertical standoffs are fastened to the high voltage charger board and are used to support the control board. Using a 5/16: nut driver, remove these standoffs.

8 You can now remove the high voltage charger and relay assembly from the chassis.

9 To remove the patient relay, disconnect each of the wires leading from the patient relay to the assembly. Be certain to label each wire. Using a Torx T-10 screwdriver, remove the single screw.

10 To remove the high voltage charger board, disconnect the three wires (two red and one white) from the high voltage capacitor and the patient inductor. Label these wires so that you can reinstall components correctly.

To install the high voltage charger board, perform the procedure "Removing the High Voltage Charger and Relay Assembly" in reverse. Refer to the Interconnect Block Diagram (Figure A-1) in Appendix A for wiring information. Refer to Figure 6-13 and Figure 6-14 for wire connections.

Removing the High Voltage Capacitor

To remove the high voltage capacitor, perform the following procedures and steps.

WARNING

The high voltage storage capacitor can store lethal amounts of energy. Be sure that this capacitor is discharged before touching high voltage components, such as the high voltage capacitor, patient inductor, patient relay, or patient cable connector. To discharge the high voltage capacitor:

1 **Be sure to wear safety glasses while discharging the capacitor.**

2 **In diagnostic mode make sure that the Available Energy is 0 (the Energy Select control is in the Monitor--On position).**

3 **Turn the Energy Select control to Off (Standby).**

4 **Wait 30 seconds before opening the unit.**

5 **After accessing the chassis as described in step 1 below, short the terminals of the high voltage capacitor using a tool with HP part number M1722-87912.**

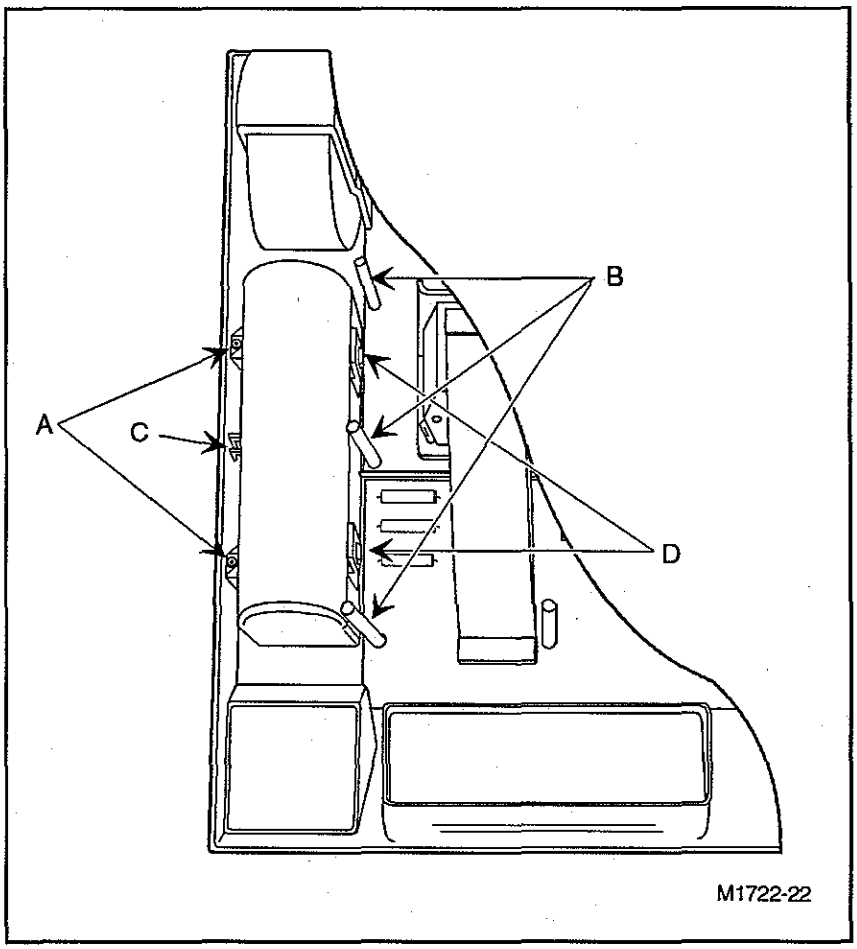
If you do not have the tool with HP part number M1722-87912, wait one hour before servicing the unit. You can then proceed using a screwdriver with an insulated handle to short the capacitor terminals.

1 Perform the procedures "Removing the Battery" and "Opening the Defibrillator Chassis".

2 Perform the procedure "Removing the Control Board". This procedure instructs you to access the chassis and also remove the CRT assembly and the pacer board.

3 The front of the defibrillator chassis should be facing you, with the high voltage capacitor to the left, as shown in Figure 6-12. Using a 5/16" nut driver, remove the three vertical standoffs positioned next to the high voltage capacitor.

Figure 6-12



Removing the High Voltage Capacitor

A. Retaining screws
B. Standoffs, remove
C. Release clip, open to the right
D. Hinge clips

4 Remove the two retaining screws that secure the capacitor cover, on the left.

5 Insert a flat-tip screwdriver under the plastic latch on the left side of the capacitor and unhook the latch. Open the plastic high voltage capacitor cover to the right and unhook the two plastic latches on the right of the cover.

6 Disconnect the two wires (one red and one white) from the high voltage charger board. On the charger board, these jacks are labeled HV RED and HV WHITE.

WARNING **Do not remove the resistor from the capacitor terminals.**

To install the high voltage capacitor, perform the procedure "Removing the High Voltage Capacitor" in reverse. Refer to Figure 6-13 and Figure 6-14 for wire connections.

WARNING **The high voltage capacitor can store lethal amounts of energy. When accessing the high voltage capacitor, be sure to follow the instructions and observe the warning under "Removing the High Voltage Capacitor".**

Removing the Patient Inductor

WARNING **The high voltage storage capacitor can store lethal amounts of energy. Be sure that this capacitor is discharged before touching high voltage components, such as the high voltage capacitor, patient inductor, patient relay, or patient cable connector. To discharge the high voltage capacitor:**

1 **Be sure to wear safety glasses while discharging the capacitor.**

2 **In diagnostic mode make sure that the Available Energy is 0 (the Energy Select control is in the Monitor--On position).**

3 **Turn the Energy Select control to Off (Standby).**

4 **Wait 30 seconds before opening the unit.**

5 **After accessing the chassis as described in step 1 below, short the terminals of the high voltage capacitor using a tool with HP part number M1722-87912.**

If you do not have the tool with HP part number M1722-87912, wait one hour before servicing the unit. You can then proceed using a screwdriver with an insulated handle to short the capacitor terminals.

To remove the patient inductor, perform the following procedures and steps.

1 Perform the procedures "Removing the Battery" and "Opening the Defibrillator Chassis".

2 Perform the procedure "Removing the Control Board". This procedure instructs you to access the chassis and also remove the pacer board, power supply, and CRT assembly.

3 At the patient inductor, disconnect and label the red wire that runs to the patient relay and the red wire that runs to the high voltage charger board.

4 Using a flat-tip screwdriver, remove the plastic retaining clip that secures the inductor to the chassis. Remove the inductor.

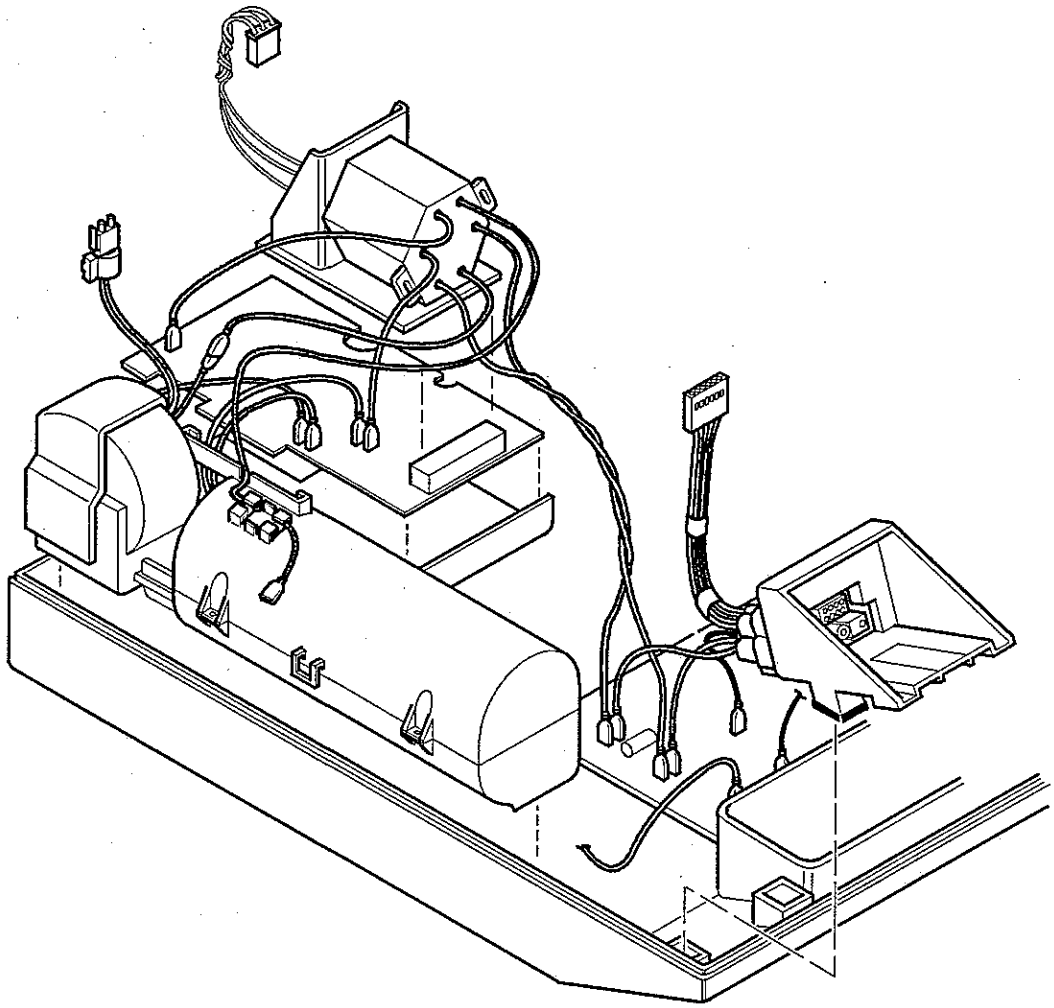
To install the patient inductor, perform the following steps.

1 Insert the patient inductor so that the wires face toward the center of the chassis. Install the plastic retaining clip to secure the inductor.

2 Connect the shortest red wire from the inductor to the shortest red wire on the patient relay. Connect the longer red wire from the inductor to the HV RED jack on the high voltage charger board.

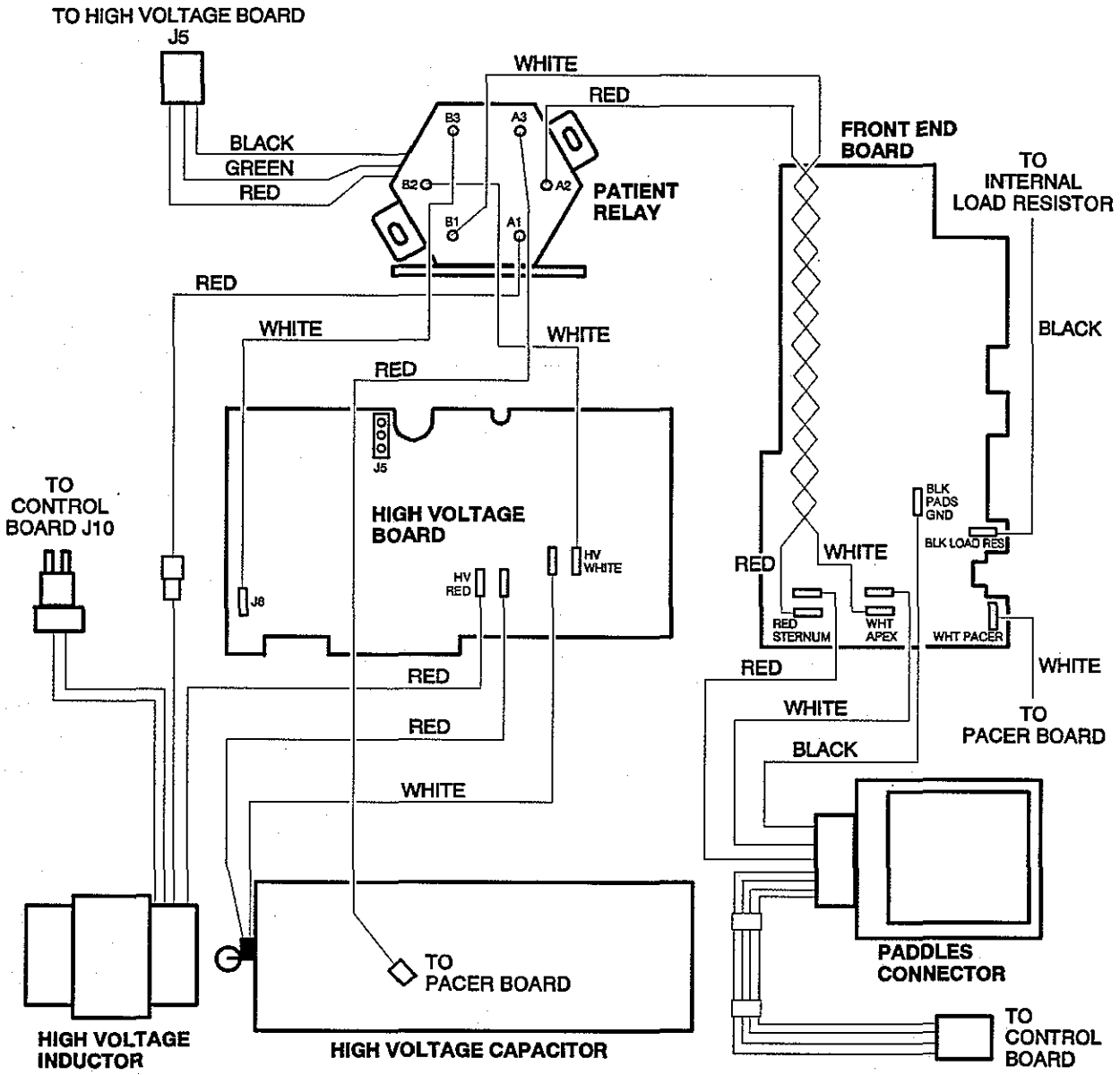
3 Perform the procedure "Removing the Patient Inductor", steps 3 through 1, in reverse order. Refer to Figure 6-13 and Figure 6-14 for wire connections. Calibrate the peak current circuitry using the procedure "Adjusting the Internal Delivered Energy Calibration" described later in this chapter.

Figure 6-13



High Voltage Connection Diagram (front view)

Figure 6-14



High Voltage Connection Diagram (schematic)

Adjusting the CRT

There are five CRT adjustments that can be performed. These adjust the intensity, vertical size, vertical position, horizontal focus and rotational position of the display. Perform the following steps to adjust the CRT.

1 Perform the procedures "Removing the Battery" and "Opening the Defibrillator Chassis". However, leave all front panel cables connected except for the optional pacer keyboard cable.

WARNING

Dangerous voltages are exposed when performing this procedure. Be certain not to touch the circuitry, wiring, or components while performing this procedure. This procedure is to be performed only by qualified service personnel.

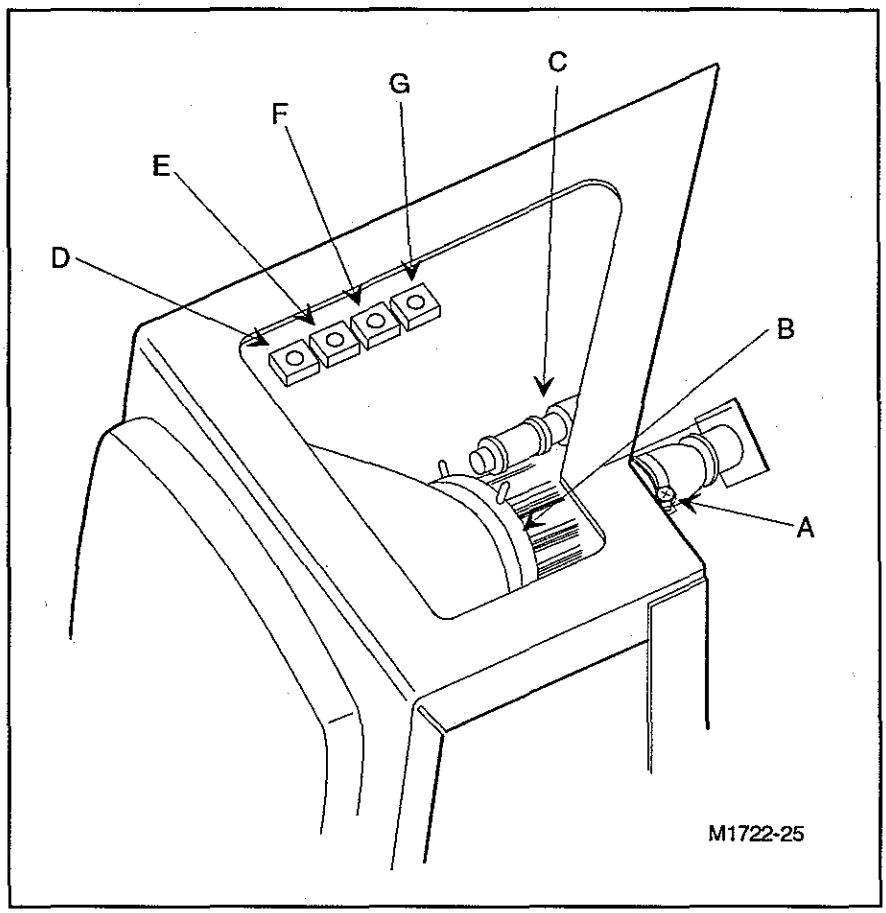
2 Be certain that AC power is removed from the defibrillator. Lift the base of the chassis up and reinstall the battery. Install and secure the battery door.

3 While pressing the (Sync) and (HR Alarm) keys, turn the Energy Select switch to **Monitor On**.

4 Press the (ECG Size) key to select TEST CRT on the screen. Then press the (Lead Select) key. The CRT test display is shown on the screen.

5 To adjust the horizontal rotation of the display, you will adjust the position of the yoke. Loosen the machine screw on the yoke clamp. Use an insulated 7/32 allen wrench. See Figure 6-15.

Figure 6-15



CRT Adjustments

A.Yoke clamp and screw
B.Yoke
C.Horizontal size adjustment
D.Vertical position adjustment
E.Vertical size adjustment
F.Focus adjustment
G.Intensity adjustment

6 Using a non-conductive probe, rotate the CRT yoke in either direction while viewing the display. Position the yoke so that the display is positioned in the most vertical/horizontal position. Tighten the yoke clamp when the display is satisfactory.

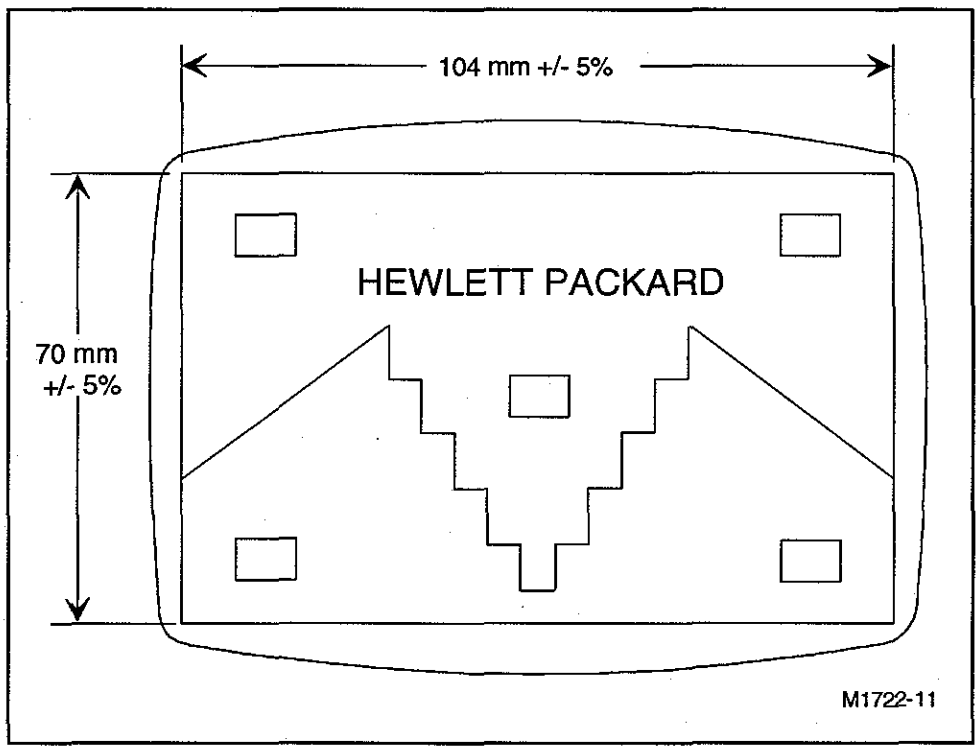
7 To adjust the horizontal size, or gain of the display, insert a 3/32" plastic Allen wrench (HP part number 8710-1355) into the back of the small inductor, located on the CRT yoke. Rotate the inductor core to adjust the horizontal size of the display so that it matches the dimensions shown in Figure 6-16.

8 To adjust horizontal centering, you must adjust magnets on the back of the yoke assembly. Place the magnets at 3:00 and 9:00 positions. Move the two magnets up (towards 12:00) together or down (towards 6:00) to shift the display image.

9 To adjust the vertical position of the display, adjust the front-most potentiometer, located on the top of the CRT deflection circuit board. Use an insulated flat-tip screwdriver.

10 To adjust the vertical size, or gain of the display, adjust the second potentiometer in line, on the top of the CRT deflection board. Set the vertical size to the dimensions shown in Figure 6-16. Use an insulated flat-tip screwdriver.

Figure 6-16



CRT Test Pattern

11 To adjust the display focus, adjust the third potentiometer in line, on the top of the CRT deflection board. Use an insulated flat-tip screwdriver.

12 To adjust the display intensity, adjust the last potentiometer in line, on the top of the CRT deflection board. Use an insulated flat-tip screwdriver.

13 Turn the Energy Select switch to **Off (Standby)**.

14 Remove the battery from the bottom of the defibrillator.

15 Reconnect the pacer cable assembly (if present) at the right-most connector on the control board.

16 Close the defibrillator chassis and install the six screws. This completes the CRT Adjustments procedure.

Adjusting the Internal Delivered Energy Calibration

On revision B and later control boards you can calibrate the Peak Current measurement circuitry in the M1722/M1723 family of defibrillator/monitors.

Perform this calibration only when replacing a control board, or Patient Inductor in the defibrillator, or when a user suspects that the reported delivered energy is incorrect.

Equipment required:

Calibrated defibrillator test box. (50 Ohm load ±1%, Measurement of delivered energy ±2%).

Insulated adjustment tool.

To calibrate the internal delivered energy measurement, perform the following steps:

1 Calibrate the defibrillator capacitor by selecting the CALIBRATE DEFIB calibration procedure in the diagnostic service mode of the instrument. Follow the instructions on the screen.

2 Charge the defibrillator to 100 Joules and discharge into the test box. Verify that the defibrillator delivered between 90 and 110 joules of energy into the test box.

Do not proceed if the defibrillator delivered less than 90 Joules or greater than 110 Joules; instead refer to Chapter 5, **Troubleshooting**, for detailed troubleshooting information.

3 If AC power is connected, remove it now.

4 Perform the procedures "Removing the Battery" and "Opening the Defibrillator Chassis". However, leave all front panel cables connected except for the optional pacer keyboard cable.

WARNING

Dangerous voltages are exposed when performing this procedure. Be certain not to touch the circuitry, wiring, or components while performing this procedure. This procedure is to be performed only by qualified service personnel.

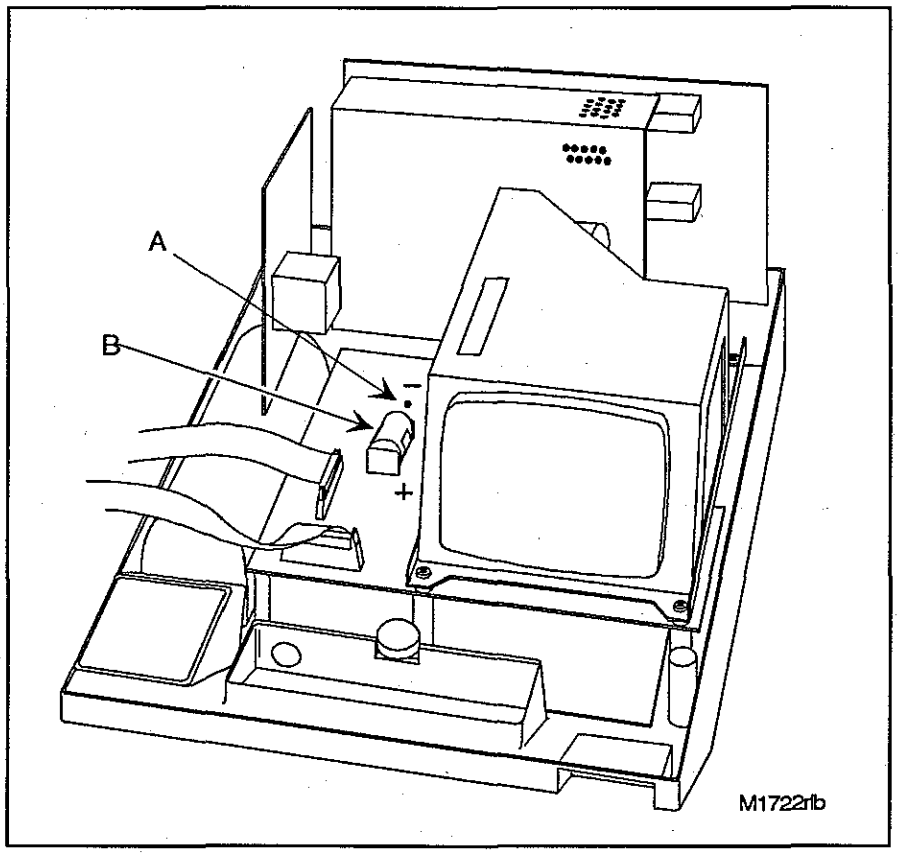
5 Lift the base of the chassis up and reinstall the battery. Install and secure the battery door.

6 While pressing the (Sync) and (HR Alarm) keys, turn the Energy Select switch to **Monitor On**.

7 Press the (ECG Size) key to select TEST DEFIB on the screen. Then press the (Lead Select) key. The TEST DEFIB screen should now be displayed on the CRT.

8 Locate the potentiometer R139 as shown in Figure 6-17.

Figure 6-17



R139 Potentiometer

A.R139 Potentiometer
B.Lithium battery

9 Attach the paddle set to the defibrillator connector.

10 Charge the defibrillator to 100 joules and discharge into the defibrillator test box.

11 Read the impedance measurement on the TEST DEFIB screen.

Example section of TEST DEFIB screen:

DELIVERED ENERGY:	100
IMPEDANCE:	50
PEAK CURRENT:	29

Adjust R139 clockwise if the displayed impedance is greater than 50 Ohms, counter- clockwise if the displayed impedance is less than 50 Ohms. Repeat from step 10 until the impedance measurement reads 50 Ohms.

12 Turn the Energy Select switch to **Off (Standby)**.

13 Remove the battery from the bottom of the defibrillator.

14 Reconnect the pacer keypanel cable assembly (if present) at the right-most connector on the control board.

15 Close the defibrillator chassis and install the six case screws. Reinstall the battery.

16 Turn the Energy Select switch to the 100 Joule position, and perform a 100 Joule delivered energy test (Paddles in pockets). Verify that the recorder prints TEST 100J PASSED. This completes the Internal Delivered Energy Measurement adjustment procedure.

Replacing the Lithium Battery

The lithium battery is located on the control board. This battery provides voltage to memory which stores setting information. To replace the battery, perform the following procedures and steps.

WARNING

Observe all lithium battery warnings. There is a risk of fire, explosion, or burns. Do not recharge, disassemble, heat above 100° C (212° F), incinerate, or solder directly on the cell. Do not short circuit the battery.

1 If the current parameter settings are still valid, print them out. You can use the print-out to restore the correct settings after replacing the battery. See "Displaying/Printing Configuration Settings" on page 2-20 for instructions on printing the current settings.

2 Perform the procedures "Removing the Battery" and "Opening the Defibrillator Chassis".

3 The lithium battery is located on the control board, left of the CRT, as shown in Figure 6-18. Using an insulated probe, remove the battery. Replace the lithium battery only with an approved HP battery (part number 1420-0341), or damage to the instrument may result. Note the polarity marking shown in the figure.

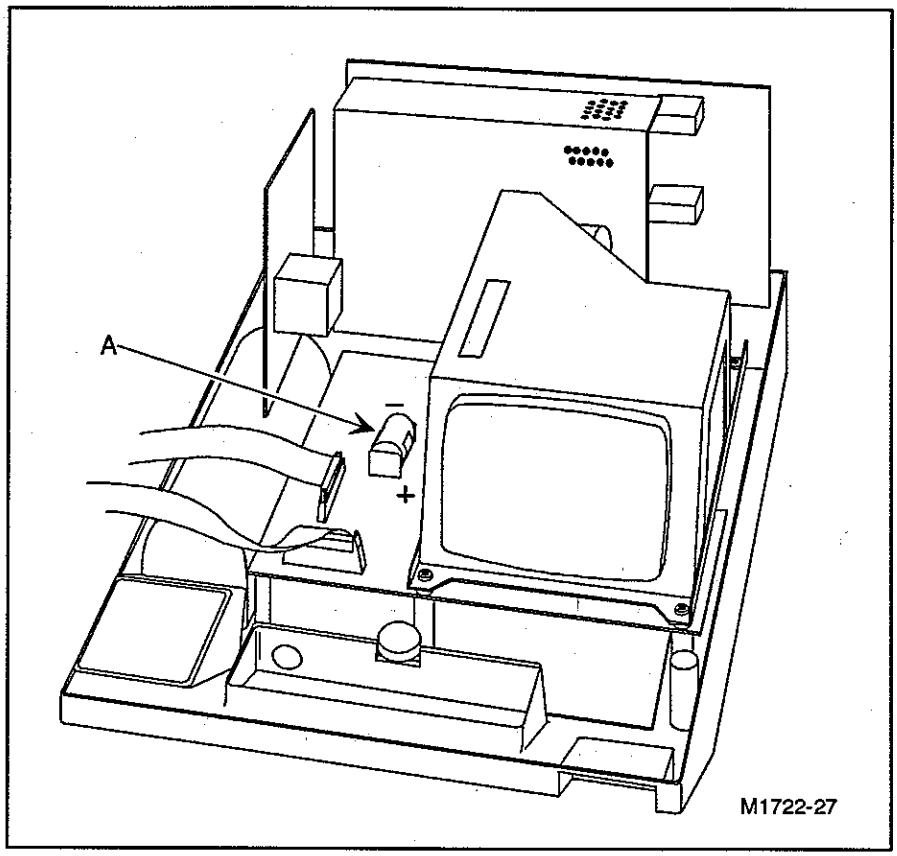
4 Reconnect any cables that were disconnected to perform this procedure.

5 Close the chassis cover. Install the six screws that secure the chassis.

6 Reinstall the lead-acid battery (on the bottom of the instrument) and battery cover.

7 When you turn on the defibrillator, it displays a message indicating that system settings have been lost. See"Changing Configuration Settings" on page 2-23 for instructions on restoring system settings. Use the printout of system settings obtained in step 1 of this procedure.

Figure 6-18



Replacing the Lithium Battery

A.Lithium battery

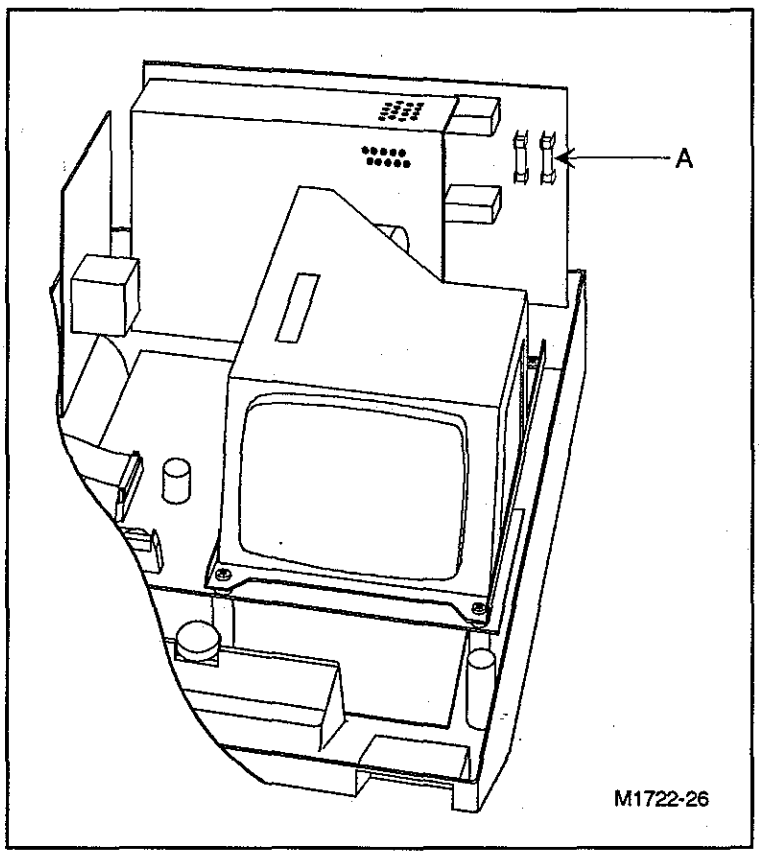
Replacing the Power Supply Fuses

There are two power supply fuses located on the power supply. To replace either fuse, perform the following procedures and steps.

1 Perform the procedures "Removing the Battery" and "Opening the Defibrillator Chassis".

2 The power supply fuses are located as shown in Figure 6-19. Replace both fuses only with 250 volt, 4.0 ampere rate fuses (HP part number 2110-0055)

Figure 6-19



Replacing the Power Supply Fuses

A.Power supply fuses

3 Reconnect all cables removed and install the chassis top cover.

4 Install the six screws that secure the chassis.

5 Reinstall the lower battery and battery cover.

Replacing the Battery Fuse

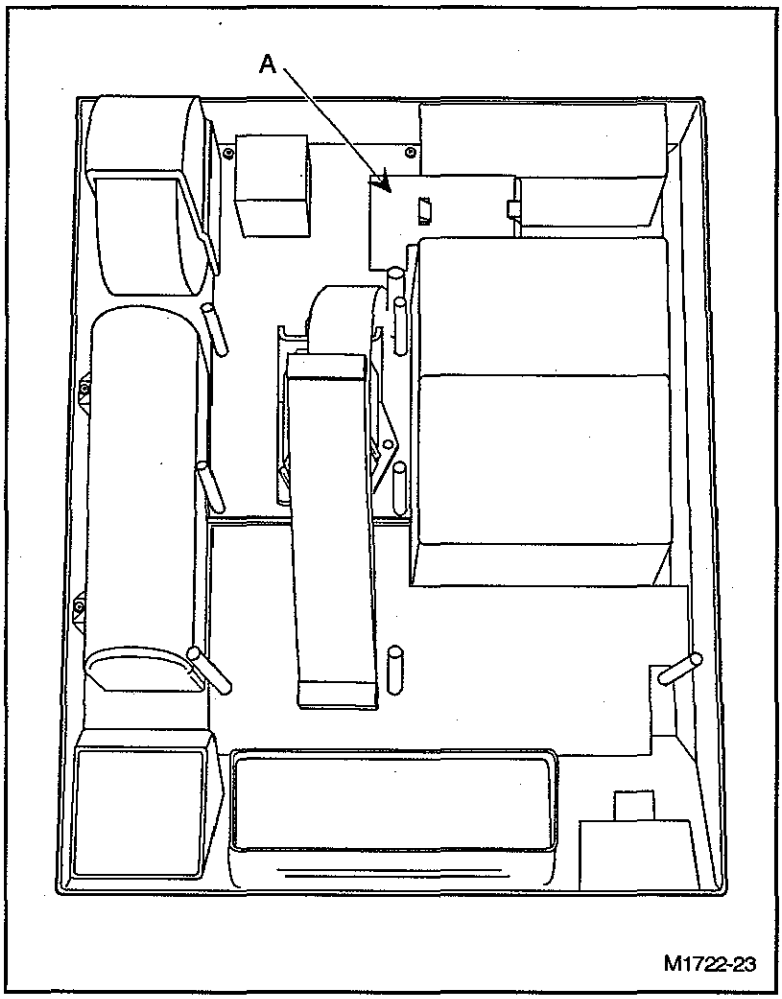
The battery fuse is located on the battery connector board, beneath the power supply and just above the high voltage charger board. To change the battery fuse, perform the following procedures and steps.

1 Perform the procedures "Removing the Battery" and "Opening the Defibrillator Chassis".

2 Perform the procedure "Removing the Power Supply Assembly".

3 The battery connector board is located behind the CRT and is held in place by a rubber plug and two plastic clips. Remove the rubber plug and then, pressing the retaining clip forward, lift the board out. See Figure 6-20.

Figure 6-20



Replacing the Battery Fuse

A.Battery connector board, with CRT assembly removed.

4 Replace the battery fuse only with a 32 volt, 25 ampere fuse (HP part number 2110- 0250)

5 Reinstall the battery connector board and the rubber plug. Be sure that board is held securely in place.

6 Reinstall the power supply assembly.

7 Reinstall all cables removed and install the chassis top cover.

8 Install the six screws that secure the chassis.

9 Reinstall the lower battery and battery cover.

Verifying Operation After Service

See Chapter 3, **Performance Verification and Maintenance**, to verify operation after service.

Parts Lists

Introduction

This chapter contains parts lists for these assemblies:

- defibrillator main assembly
- battery door
- key panel assembly
- high voltage assembly
- CRT assembly
- recorder
- external paddle sets

In addition, Table 7-11 lists ordering information for supplies.

The CodeMaster Models

The CodeMaster defibrillator/monitor is available in two models:

- XL+ is model M1722A or M1722B
- XL is model M1723A or M1723B

NOTE

Both models are available in a white- or yellow-colored enclosure. The model with the suffix *A* is white; suffix *B* is for the yellow color. Consequently, some parts in the parts list are available in both colors—primarily case parts and labels. Parts in white and yellow have different part numbers.

Ordering Information

You may order any of the parts listed through your local Hewlett-Packard Sales/ Service Office (listed at the back of this manual). In the United States and Canada, you can call the Direct Customer Order Center (toll-free) 1-800-227-8164.

In the United States, you can order medical supplies for the defibrillator by calling (toll-free) 1-800-225-0230.

Calling for Assistance

You can call Hewlett-Packard Service for technical assistance.

United States of America

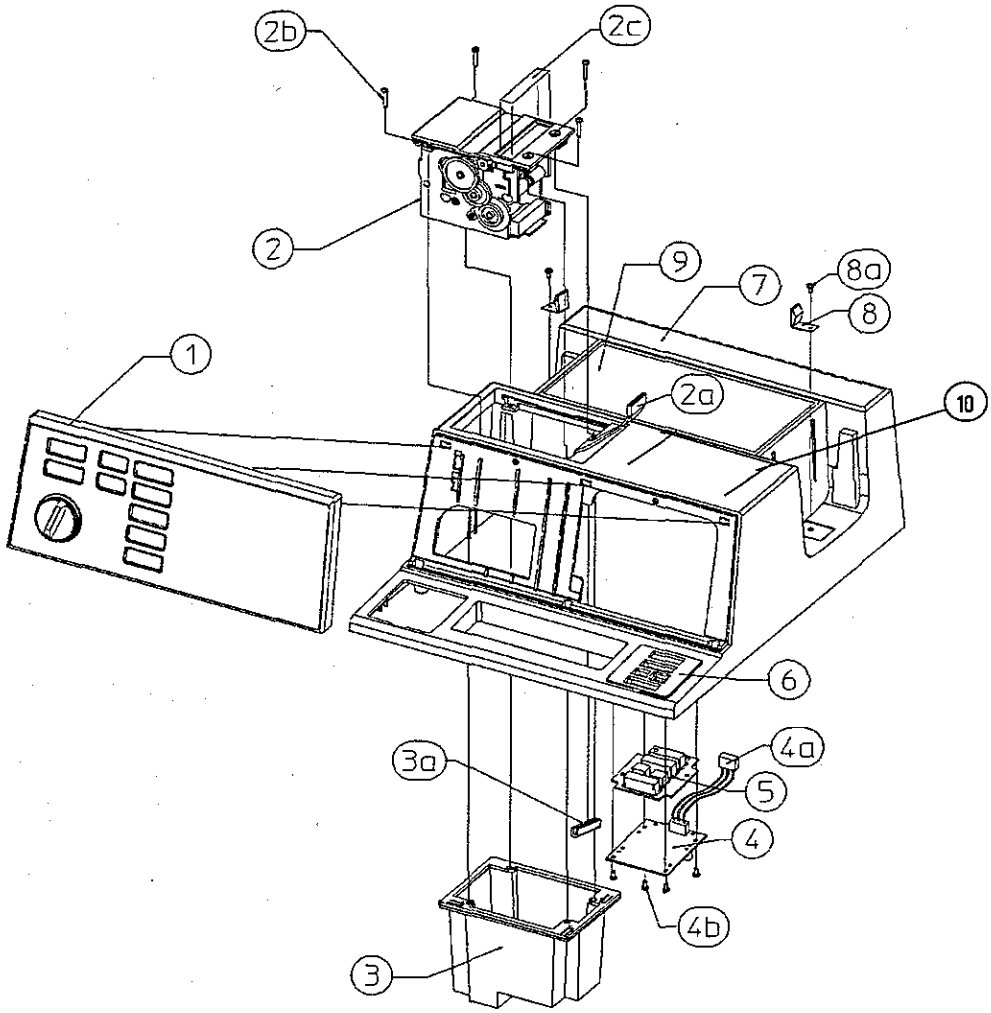
Eastern Region	Tel: 1-800-245-4406
Western Region	Tel: 1-800-428-0949
Southern Region	Tel: 1-800-845-8374
Midwestern Region	Tel: 1-800-323-2280

Canada

Eastern Region	Tel: 1-800-361-9790
Central and Western Region	Tel: 1-800-268- 1221

In other countries, contact your local Hewlett-Packard service office. Consult the listing at the back of this manual for office locations and information.

Figure 7-1



Top Case Parts List

Table 7-1 Top Case Parts List

Ref. No.	Description	Part No.	Part No. With Shock Advisory
1	Keypanel assembly part numbers.	See Table 7-5.	
1	Keypanel assembly without SpO_2—English, (M1722A/B)	M1722-69500	M1722-69610
	Keypanel assembly without SpO_2—French, (M1722A/B)	M1722-69501	M1722-69611
	Keypanel assembly without SpO_2—German, (M1722A/B)	M1722-69502	M1722-69612
	Keypanel assembly without SpO_2—Dutch, (M1722A/B)	M1722-69503	M1722-69613
	Keypanel assembly without SpO_2—Spanish, (M1722A/B)	M1722-69504	M1722-69614
	Keypanel assembly without SpO_2—Italian, (M1722A/B)	M1722-69505	M1722-69615
	Keypanel assembly without SpO_2—Swedish, (M1722A/B)	M1722-69506	M1722-69616
	Keypanel assembly without SpO_2—Japanese, (M1722A/B)	M1722-69507	M1722-69617

Table 7-1 Top Case Parts List

Ref. No.	Description	Part No.	Part No. With Shock Advisory
1	Keypanel assembly without SpO_2—Norwegian, (M1722A/B)	M1722-69508	M1722-69618
	Keypanel assembly without SpO_2—Finnish, (M1722A/B)	M1722-69509	M1722-69619
	Keypanel assembly without SpO_2—Danish, (M1722A/B)	M1722-69510	M1722-69620
1	Keypanel assembly with SpO_2—English (M1722A/B)	M1722-69650	M1722-6930
	Keypanel assembly with SpO_2—French (M1722A/B)	M1722-69651	M1722-6931
	Keypanel assembly with SpO_2—German (M1722A/B)	M1722-69652	M1722-6932
	Keypanel assembly with SpO_2—Dutch (M1722A/B)	M1722-69653	M1722-6933
	Keypanel assembly with SpO_2—Spanish (M1722A/B)	M1722-69654	M1722-6934
	Keypanel assembly with SpO_2— Italian (M1722A/B)	M1722-69655	M1722-6935
	Keypanel assembly with SpO_2— Swedish (M1722A/B)	M1722-69656	M1722-6936
	Keypanel assembly with SpO_2— Japanese (M1722A/B)	M1722-69657	M1722-6937
	Keypanel assembly with SpO_2— Norwegian (M1722A/B)	M1722-69658	M1722-6938
	Keypanel assembly with SpO_2— Finnish (M1722A/B)	M1722-69659	M1722-6939
	Keypanel assembly with SpO_2— Danish (M1722A/B)	M1722-69660	M1722-6940
1	Keypanel assembly without SpO_2—English, (M1723A/B)	M1723-69510	M1723-69610
	Keypanel assembly without SpO_2—French, (M1723A/B)	M1723-69511	M1723-69611
	Keypanel assembly without SpO_2—German, (M1723A/B)	M1723-69512	M1723-69612
	Keypanel assembly without SpO_2—Dutch, (M1723A/B)	M1723-69513	M1723-69613
	Keypanel assembly without SpO_2—Spanish, (M1723A/B)	M1723-69514	M1723-69614
	Keypanel assembly without SpO_2—Italian, (M1723A/B)	M1723-69515	M1723-69615
	Keypanel assembly without SpO_2—Swedish, (M1723A/B)	M1723-69516	M1723-69616
	Keypanel assembly without SpO_2—Japanese, (M1723A/B)	M1723-69517	M1723-69617
	Keypanel assembly without SpO_2—Norwegian, (M1723A/B)	M1723-69518	M1723-69618
	Keypanel assembly without SpO_2—Finnish, (M1723A/B)	M1723-69519	M1723-69619
	Keypanel assembly without SpO_2—Danish, (M1723A/B)	M1723-69520	M1723-69620
1	Keypanel assembly with SpO_2—English (M1723A/B)	M1723-69600	M1723-69620
	Keypanel assembly with SpO_2—French (M1723A/B)	M1723-69601	M1723-69630
	Keypanel assembly with SpO_2—German (M1723A/B)	M1723-69602	M1723-69631
	Keypanel assembly with SpO_2—Dutch (M1723A/B)	M1723-69603	M1723-69632
	Keypanel assembly with SpO_2—Spanish (M1723A/B)	M1723-69604	M1723-69633
	Keypanel assembly with SpO_2—Italian (M1723A/B)	M1723-69605	M1723-69634
	Keypanel assembly with SpO_2—Swedish (M1723A/B)	M1723-69606	M1723-69635
	Keypanel assembly with SpO_2—Japanese (M1723A/B)	M1723-69607	M1723-69636
	Keypanel assembly with SpO_2—Norwegian (M1723A/B)	M1723-69608	M1723-69637
	Keypanel assembly with SpO_2—Finnish (M1723A/B)	M1723-69609	M1723-69638
	Keypanel assembly with SpO_2—Danish (M1723A/B)	M1723-69610	M1723-69639
2	Recorder assembly (M1722A, M1723A)	M1722-69520	
2a	Cable, recorder	M1722-61618	

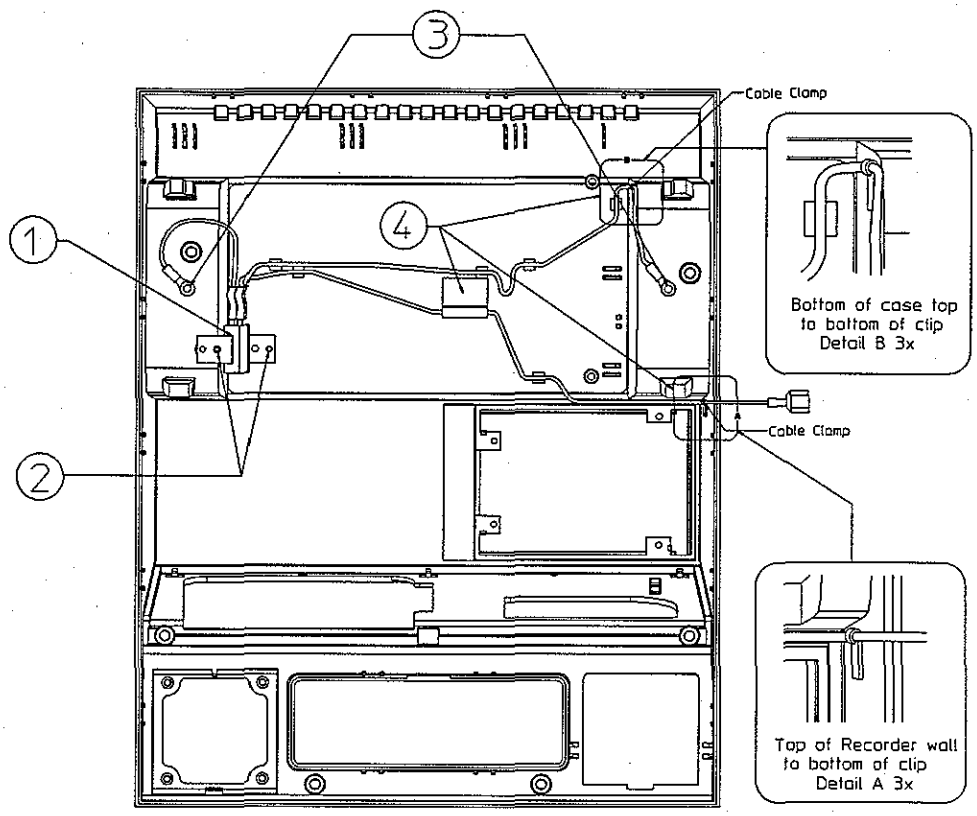
Table 7-1 Top Case Parts List

Ref. No.	Description	Part No.	Part No. With Shock Advisory
2b	Screw, M3 x 16 (qty.4)	0515-0375	
2c	Label (white) (M1722A, M1723A)	M1722-84580	
	Label (yellow) (M1722B, M1723B)	M1722-84581	
3	Bucket assembly (gasket and bucket)	M1722-67460	
3a	Gasket, Recorder Channel	M1722-87906	
4	Pacer keyboard PCA, (M1722A/B)	M1722-60185	
4a	Cable, pacer keyboard	M1722-61605	
4b	Screw, M3 x 10 (qty.4) (Pacer to cover)	0515-0374	
5	Pacer keypad—English, (M1722A/B)	M1722-84410	
	Pacer keypad—French, (M1722A/B)	M1722-84411	
	Pacer keypad—German, (M1722A/B)	M1722-84412	
	Pacer keypad—Dutch, (M1722A/B)	M1722-84413	
	Pacer keypad—Spanish, (M1722A/B)	M1722-84414	
	Pacer keypad—Italian, (M1722A/B)	M1722-84415	
	Pacer keypad—Swedish, (M1722A/B)	M1722-84416	
	Pacer keypad—Japanese, (M1722A/B)	M1722-84417	
	Pacer keypad—Norwegian, (M1722A/B)	M1722-84440	
	Pacer keypad—Finnish, (M1722A/B)	M1722-84441	
	Pacer keypad—Danish, (M1722A/B)	M1722-84442	
6	Bezel—pacer (white), (M1722A)	M1722-47221	
	Bezel—pacer (yellow), (M1722B)	M1722-47291	
	Bezel—no pacer (white), (M1722A, M1723A)	M1722-47209	
	Bezel—no pacer (yellow), (M1722B, M1723B)	M1722-47299	
7	Cover, top (white), (M1722A, M1723A) (Requires case label set)	M1722-47200	
	Cover, top (yellow), (M1722B M1723B) (Requires case label set)	M1722-47290	
8	Contactor, paddle	M1722-04701	
8a	Screw—M3 x 4 (Paddle retainers)	0515-0663	

Table 7-1 Top Case Parts List

Ref. No.	Description	Part No.	Part No. With Shock Advisory
9	Case labels—English (white), (M1722A, M1723A)	M1722-84510	
	Case labels—French (white), (M1722A, M1723A)	M1722-84511	
	Case labels—German (white), (M1722A, M1723A)	M1722-84512	
	Case labels—Dutch (white), (M1722A, M1723A)	M1722-84513	
	Case labels—Spanish (white), (M1722A, M1723A)	M1722-84514	
	Case labels—Italian (white), (M1722A, M1723A)	M1722-84515	
	Case labels—Swedish (white), (M1722A, M1723A)	M1722-84516	
	Case labels—Japanese (white), (M1722A, M1723A)	M1722-84517	
	Case labels—Norwegian (white), (M1722A, M1723A)	M1722-84550	
	Case labels—Finnish (white), (M1722A, M1723A)	M1722-84551	
	Case labels—Danish (white), (M1722A, M1723A)	M1722-84552	
9	Case labels—English (yellow), (M1722B, M1723B)	M1722-84210	
	Case labels—French (yellow), (M1722B, M1723B)	M1722-84211	
	Case labels—German (yellow), (M1722B, M1723B)	M1722-84212	
	Case labels—Dutch (yellow), (M1722B, M1723B)	M1722-84213	
	Case labels—Spanish (yellow), (M1722B, M1723B)	M1722-84214	
	Case labels—Italian (yellow), (M1722B, M1723B)	M1722-84215	
	Case labels—Swedish (yellow), (M1722B, M1723B)	M1722-84216	
	Case labels—Japanese (yellow), (M1722B, M1723B)	M1722-84217	
	Case labels—Norwegian (yellow), (M1722B, M1723B)	M1722-84240	
	Case labels—Finnish (yellow), (M1722B, M1723B)	M1722-84241	
	Case labels—Danish (yellow), (M1722B, M1723B)	M1722-84242	
10	Advisory Mode Instruction Label English		M1722-84120
	Advisory Mode Instruction Label French		M1722-84121
	Advisory Mode Instruction Label German		M1722-84122
	Advisory Mode Instruction Label Dutch		M1722-84123
	Advisory Mode Instruction Label Spanish		M1722-84124
	Advisory Mode Instruction Label Italian		M1722-84125
	Advisory Mode Instruction Label Swedish		M1722-84126
	Advisory Mode Instruction Label Japanese		M1722-84127
	Advisory Mode Instruction Label Norwegian		M1722-84128
	Advisory Mode Instruction Label Finnish		M1722-84129
	Advisory Mode Instruction Label Danish		M1722-84130

Figure 7-2

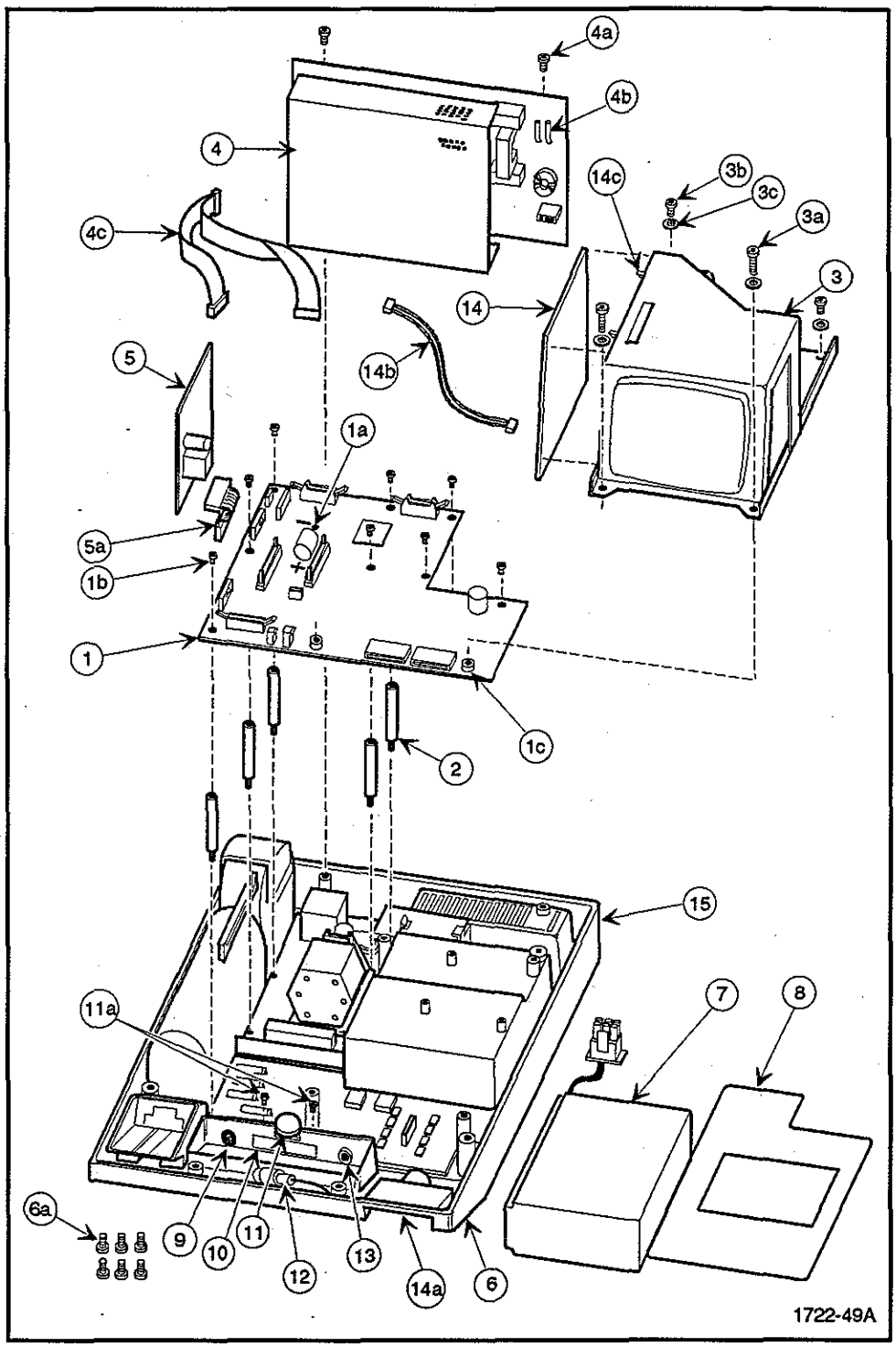


Top Case–Inside

Table 7-2 **Top Case–Inside Parts List**

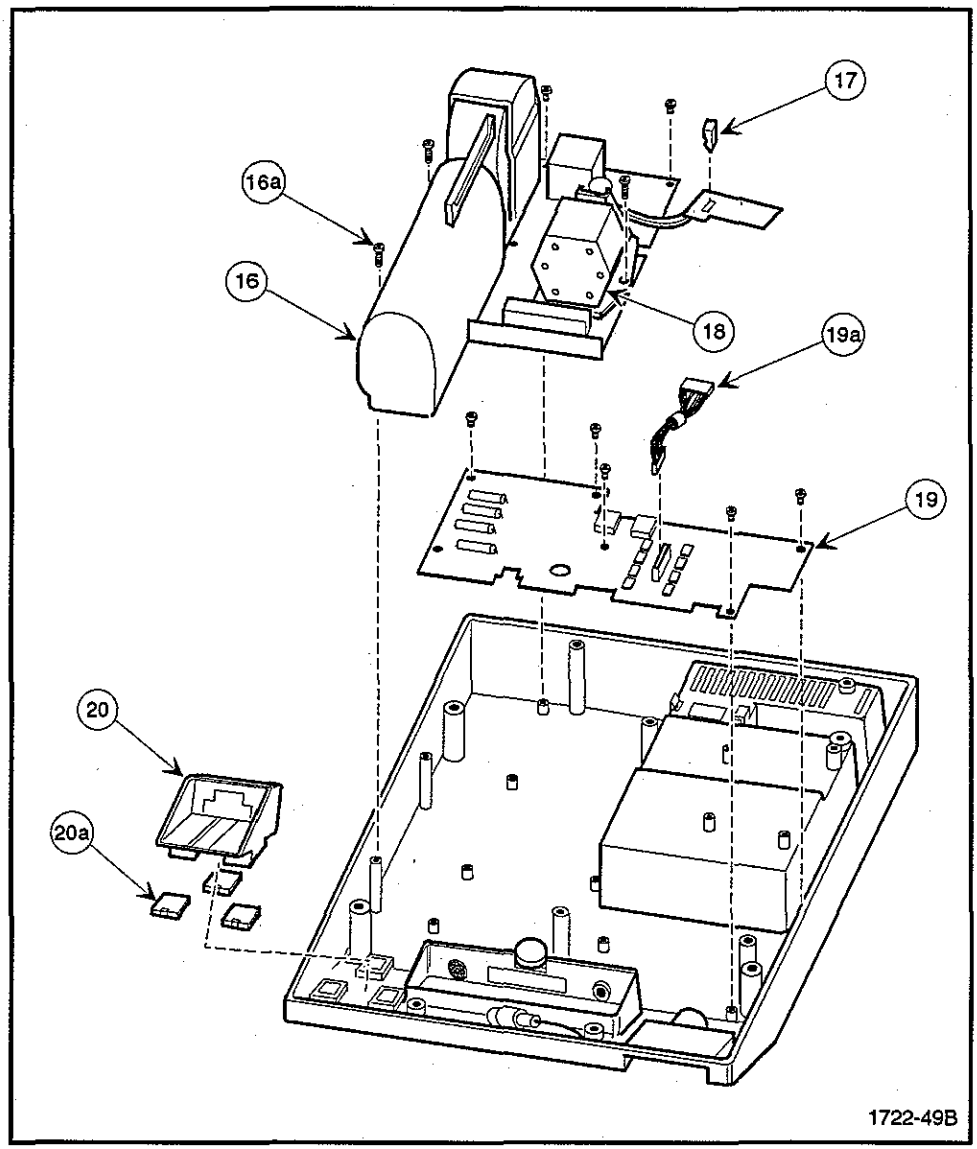
Ref. No.	Description	Part No.
1	Resistor assembly, patient load	M1722-60010
2	Screw, M3 x 10 (qty. 2)	0515-0374
3	Screw, M3 x 4 (qty. 2)	0515-0663
4	Cable clamp (qty. 3)	1400-1568

Figure 7-3



Bottom Case

Figure 7-4



Bottom Case

Table 7-3

Bottom Case Parts List

Ref. No.	Description	Part No.
1	Control PCA, (M1722A/B, M1723A/B)	M1722-60100
1a	Battery, lithium 3V, 1.2AH	1420-0341
1b	Screw, M3 x 10 (qty. 8)	0515-0374
1c	Press-fit standoffs	M1722-27302

Table 7-3 **Bottom Case Parts List**

Ref. No.	Description	Part No.
2	Standoff, insulated (qty. 5)	M1722-47277
3	CRT Assembly, (M1722A/B, M1723A/B)	M1722-67210
3a	Screw, M4 x 18	0515-0436
3b	Screw, M4 x 10	0515-0380
3c	Washer (qty. 4)	2190-0419 See Table 7-7
4	Power Supply assembly	M1722-69530
4a	Screw, M4 x 10 (qty. 2)	0515-0380
4b	Fuse, 4A 250V Fast	2110-0055
4c	Power supply cable	M1722-61606
5	Pacer PCA, (M1722A/B)	M1722-60170
5a	Cable, Pacer/Control	M1722-61617
6	Case, bottom (white), (M1722A, M1723A) (Requires case label set, see Table 7-1.) (Includes feet, battery compartment pad, receptacle pads, two plugs and SpO_2 case labels.)	M1722-69561
	Case, bottom (yellow), (M1722B, M1723B) (Requires case label set, see Table 7-1.) (Includes feet, battery compartment pad, receptacle pads, two plugs and SpO_2 case labels.)	M1722-69562
	Foot, plastic, (qty. 4)	0403-0767
	Pad, Battery Compartment	M1722-47213
	SpO_2 Case Labels (White, English)	M1722-84553
	SpO_2 Case Labels (White, International)	M1722-84554
	SpO_2 Case Labels (Yellow, English)	M1722-84555
	SpO_2 Case Labels (Yellow, International)	M1722-84556
	Plug—No SpO_2 (Yellow)	M1722-47103
	Plug—No SpO_2 (white)	M1724-47101
6a	Screw, M4 x 10 (qty. 6)	0515-0380
7	Battery assembly, lead-acid	M1758A

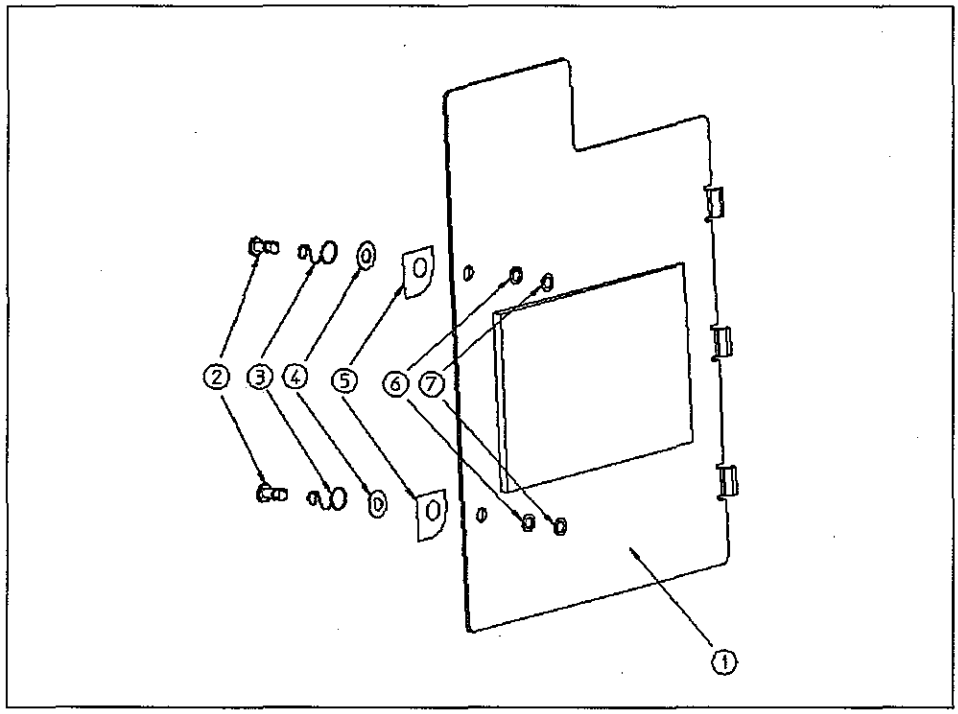
Table 7-3 **Bottom Case Parts List**

Ref. No.	Description	Part No.
8	Battery door assembly (white), (M1722A, M1723A) (Requires case label set, see Table 7-1.)	M1722-62720
	Battery door assembly (yellow), (M1722B, M1723B) (Requires case label set, see Table 7-1.)	M1722-62790 See Table 7-4
9	ECG In cable, 6-pin	M1722-61614
	ECG In cable, 8-pin	M1722-61615
	ECG In cable, 12-pin	M1722-61616
10	Label (part of case label set)	See Table 7-1.
11	QRS volume control assembly	M1722-61910
11a	Screw, M3 x 10 (qty. 2)	0515-0374
12	Beeper	M1722-61632
13	Cable—ECG Out/Sync	M1722-61624
13a	Ring nut 3/8 in (not shown)	0590-0856
13b	Lockwasher, 3/8 in (not shown)	2190-0579
14	SpO_2 PCA	M1722-60102
14a	SpO_2 Connector	M1722-61651
14b	SpO_2 to keyboard cable	M1722-61652
14c	Tie locks (set of 5)	5180-2105
14d	Insulator, mylar (not shown)	M1722-87913
15	AC input receptacle	M1722-61607
16	High Voltage Assembly, (M1722A/B, M1723A/B)	See Table 7-6
16a	Screw, M3 x 10 (qty. 4)	0515-0374
17	Plug, Securing (Battery connector)	M1722-47241
18	Patient Relay Assembly	See Table 7-6.
19	Front End PCA, (M1722A/B, M1723A/B)	M1722-60120
19a	Cable—Front End/Control	M1722-61611
20	Receptacle assembly—paddle (includes 14a - 14d)	M1722-61626
20a	Pad (qty. 3)	M1722-47237
20b	Cable, paddle receptacle (not shown)	M1722-61620
20c	Receptacle, body (not shown)	M1722-47204

Table 7-3 **Bottom Case Parts List**

Ref. No.	Description	Part No.
20d	Screw, tapping 2-28 (not shown)	0624-0612
21	Ground lug (not shown)	1251-5964
21a	Washer, flat (not shown)	78620-00849
21b	Nut, hex (qty. 2)(not shown)	0590-0565
21c	Washer, lock (not shown)	2190-0084

Figure 7-5

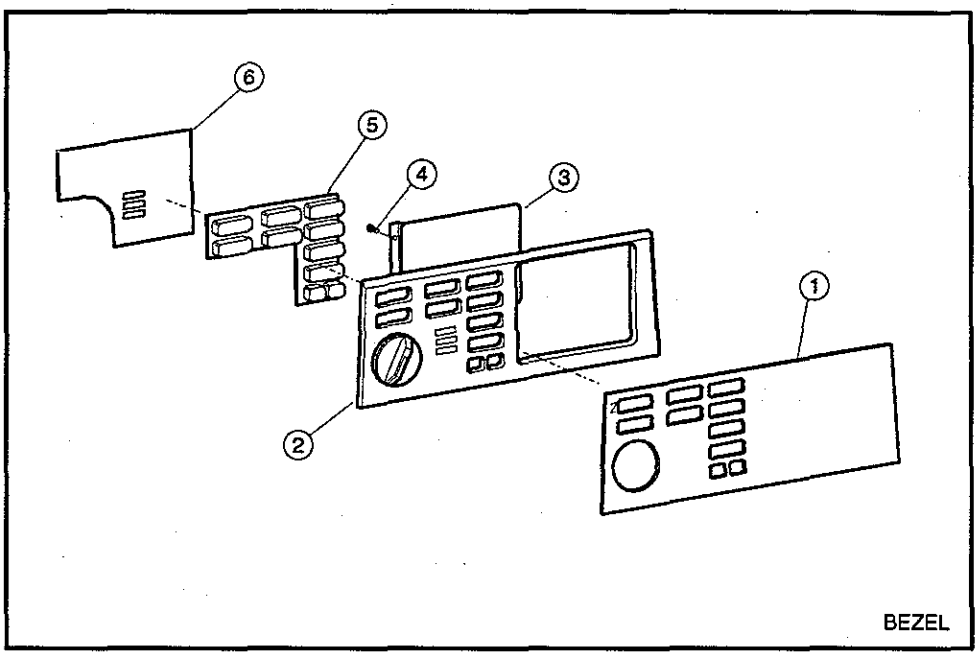


Battery Door Assembly

Table 7-4 **Battery Door Assembly Parts List**

Ref. No.	Description	Part No.
1	Battery door assembly (white), (M1722A, M1723A) (includes items numbered 2 through 7)	M1722-62720
	Battery door assembly (yellow), (M1722B, M1723B) (includes items numbered 2 through 7)	M1722-62790
2	Fastener, 1/4 turn (qty. 2)	1390-1004
3	Spring (qty. 2)	1460-2348
4	Washer, nylon (qty. 2)	3050-1400
5	Labels, door lock (qty. 2)	M1722-84538
6	Washer, split	1390-0435
7	Washer, nylon	1390-1005
8	Label (Part of case label set)	See Table 7-1.

Figure 7-6



Key Panel Assembly

Table 7-5 Keypanel Assembly Parts List

Ref. No.	Description	Part No.	Shock Advisory Part No.
1	Keylabel without SpO_2—English (M1722A/B)	M1722-84530	M1722-84530
	Keylabel without SpO_2—French (M1722A/B)	M1722-84531	M1722-84531
	Keylabel without SpO_2—German (M1722A/B)	M1722-84532	M1722-84532
	Keylabel without SpO_2—Dutch (M1722A/B)	M1722-84533	M1722-84533
	Keylabel without SpO_2—Spanish (M1722A/B)	M1722-84534	M1722-84534
	Keylabel without SpO_2—Italian (M1722A/B)	M1722-84535	M1722-84535
	Keylabel without SpO_2—Swedish (M1722A/B)	M1722-84536	M1722-84536
	Keylabel without SpO_2—Japanese (M1722A/B)	M1722-84537	M1722-84537
	Keylabel without SpO_2—Norwegian (M1722A/B)	M1722-84570	M1722-84538
	Keylabel without SpO_2—Finnish (M1722A/B)	M1722-84571	M1722-84539
	Keylabel without SpO_2—Danish (M1722A/B)	M1722-84572	M1722-84540

Table 7-5 Keypanel Assembly Parts List

Ref. No.	Description	Part No.	Shock Advisory Part No.
1	Keylabel with SpO_2—English (M1722A/B)	M1722-84920	M1722-84920
	Keylabel with SpO_2—French (M1722A/B)	M1722-84921	M1722-84921
	Keylabel with SpO_2—German (M1722A/B)	M1722-84922	M1722-84922
	Keylabel with SpO_2—Dutch (M1722A/B)	M1722-84923	M1722-84923
	Keylabel with SpO_2—Spanish (M1722A/B)	M1722-84924	M1722-84924
	Keylabel with SpO_2—Italian (M1722A/B)	M1722-84925	M1722-84925
	Keylabel with SpO_2—Swedish (M1722A/B)	M1722-84926	M1722-84926
	Keylabel with SpO_2—Japanese (M1722A/B)	M1722-84927	M1722-84927
	Keylabel with SpO_2—Norwegian (M1722A/B)	M1722-84928	M1722-84928
	Keylabel with SpO_2—Finnish (M1722A/B)	M1722-89429	M1722-89429
	Keylabel with SpO_2—Danish (M1722A/B)	M1722-84930	M1722-84930
1	Keylabel without SpO_2—English (M1723A/B)	M1723-84330	M1723-84900
	Keylabel without SpO_2—French (M1723A/B)	M1723-84331	M1723-84901
	Keylabel without SpO_2—German (M1723A/B)	M1723-84332	M1723-84902
	Keylabel without SpO_2—Dutch (M1723A/B)	M1723-84333	M1723-84903
	Keylabel without SpO_2—Spanish (M1723A/B)	M1723-84334	M1723-84904
	Keylabel without SpO_2—Italian (M1723A/B)	M1723-84335	M1723-84905
	Keylabel without SpO_2—Swedish (M1723A/B)	M1723-84336	M1723-84906
	Keylabel without SpO_2—Japanese (M1723A/B)	M1723-84337	M1723-84907
	Keylabel without SpO_2—Norwegian (M1723A/B)	M1723-84338	M1723-84908
	Keylabel without SpO_2—Finnish (M1723A/B)	M1723-84339	M1723-84909
	Keylabel without SpO_2—Danish (M1723A/B)	M1723-84340	M1723-84910

Table 7-5 Keypanel Assembly Parts List

Ref. No.	Description	Part No.	Shock Advisory Part No.
1	Keylabel with SpO_2—English (M1723A/B)	M1723-84420	M1723-84920
	Keylabel with SpO_2—French (M1723A/B)	M1723-84421	M1723-84921
	Keylabel with SpO_2—German (M1723A/B)	M1723-84422	M1723-84922
	Keylabel with SpO_2—Dutch (M1723A/B)	M1723-84423	M1723-84923
	Keylabel with SpO_2—Spanish (M1723A/B)	M1723-84424	M1723-84924
	Keylabel with SpO_2—Italian (M1723A/B)	M1723-84425	M1723-84925
	Keylabel with SpO_2—Swedish (M1723A/B)	M1723-84426	M1723-84926
	Keylabel with SpO_2—Japanese (M1723A/B)	M1723-84427	M1723-84927
	Keylabel with SpO_2—Norwegian (M1723A/B)	M1723-84428	M1723-84928
	Keylabel with SpO_2—Finnish (M1723A/B)	M1723-84429	M1723-84929
	Keylabel with SpO_2—Danish (M1723A/B)	M1723-84430	M1723-84930
2	Bezel/Energy select switch without SpO_2 (M1722A/B)	M1722-67220	
	Bezel/Energy select switch without SpO_2 (M1723A/B)	M1723-67221	
	Bezel/ Energy select switch with SpO_2 (M1722A/B)	M1722-67222	
	Bezel/ Energy select switch with SpO_2 (M1723A/B)	M1723-67223	
3	Lens—CRT	M1722-47501	
4	Screw, M3 x 10 (qty 2)	0515-0374	

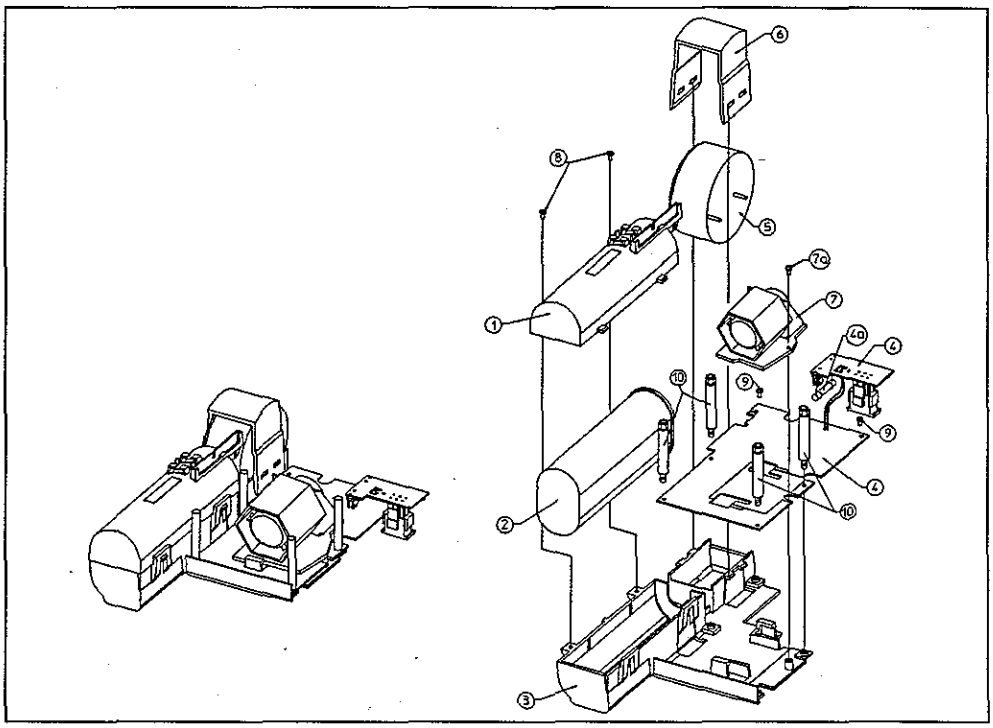
Table 7-5 Keypanel Assembly Parts List

Ref. No.	Description	Part No.	Shock Advisory Part No.
5	Keypad[1]—English, (M1722A/B, M1723A/B)	M1722-84400	M1722-84450
	Keypad[1]—French, (M1722A/B, M1723A/B)	M1722-84401	M1722-84451
	Keypad[1]—German, (M1722A/B, M1723A/B)	M1722-84402	M1722-84452
	Keypad[1]—Dutch, (M1722A/B, M1723A/B)	M1722-84403	M1722-84453
	Keypad[1]—Spanish, (M1722A/B, M1723A/B)	M1722-84404	M1722-84454
	Keypad[1]—Italian, (M1722A/B, M1723A/B)	M1722-84405	M1722-84455
	Keypad[1]—Swedish, (M1722A/B, M1723A/B)	M1722-84406	M1722-84456
	Keypad[1]—Japanese, (M1722A/B,M1723A/B)	M1722-84407	M1722-84457
	Keypad[1]—Norwegian, (M1722A/B, M1723A/B)	M1722-84430	M1722-84458
	Keypad[1]—Finnish, (M1722A/B, M1723A/B)	M1722-84431	M1722-84459
	Keypad[1]—Danish, (M1722A/B, M1723A/B)	M1722-84432	M1722-84460
6	Keypanel, PCA[2]	M1722-60195	

1 The keypad may include more keys than the instrument allows. Cut out all unnecessary keys. The cut should be made to leave a hole in place of the key.

2 This Keypanel PCA is used in both the M1722 and M1723. To use this keypanel in the M1723A/B, you must first cut a trace on the circuit board. See "Removing and Disassembling the Keypanel Assembly" on page 6-9 for detailed information.

Figure 7-7



High Voltage Assembly

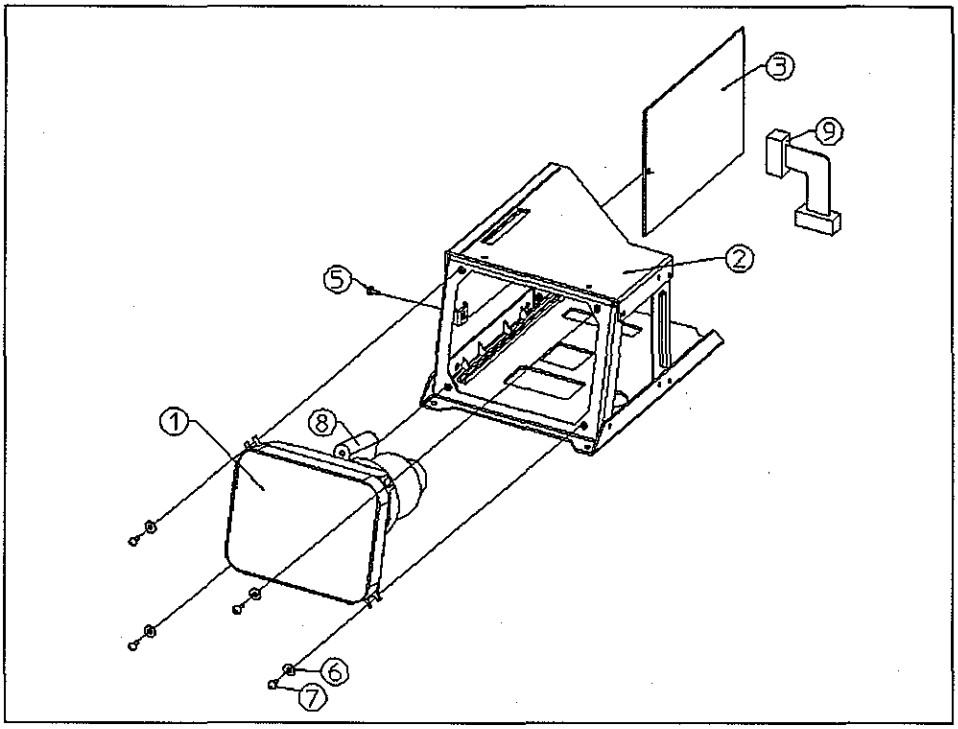
Table 7-6 **High Voltage Assembly Parts List**

Ref. No.	Description	Part No.
1	HV Capacitor Retainer	M1722-67304
2	HV Capacitor	M1722-82801
3	HV Retainer	M1722-47305
4	High Voltage PCA (includes battery board)	M1722-60110
4a	Fuse, 25A, 32V	2110-0250
5	Inductor	M1722-82800
6	Inductor Retainer	M1722-47306
7	Patient Relay Assembly (includes patient relay and bracket)	M1722-62805
	Relay, Patient	M1722-82806
	Relay Bracket	M1722-01205
7a	Screw, M3x16 (qty. 1)	0515-0375

Table 7-6 **High Voltage Assembly Parts List**

Ref. No.	Description	Part No.
8, 9	Screw—M3 x 10 (qty. 4)	0515-0374
10	Stand-offs (qty. 4)	M1722-47227

Figure 7-8

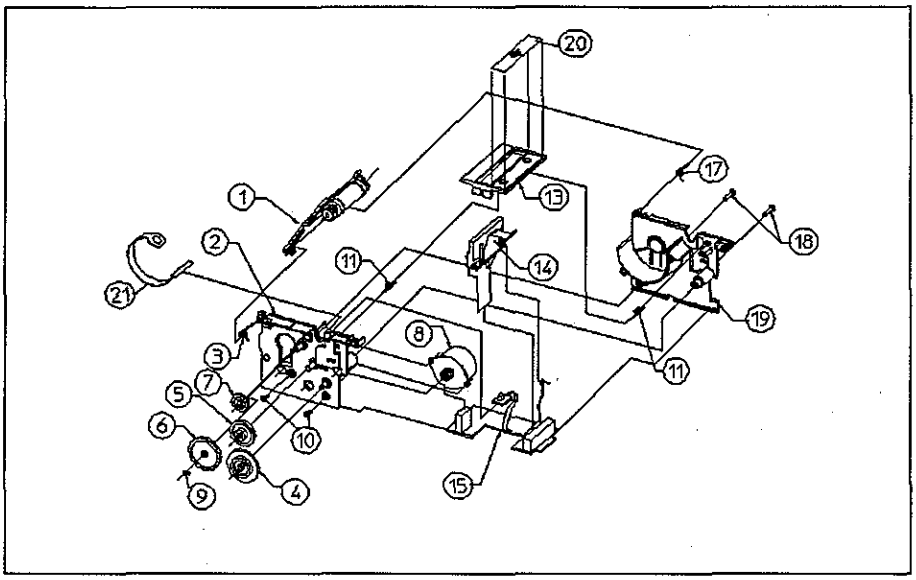


CRT Assembly

Table 7-7 **CRT Assembly Parts List**

Ref. No.	Description	Part No.
	CRT Assembly (M1722A/B) (M1723A/B) (includes items 1 through 8)	M1722- 67210
1	CRT Tube	M1722-62810
2	CRT Chassis	M1722-07301
3	Deflection PCA	M1722-60130
5	Screw—M3x10 (qty. 1)	0515-0374
6	Washer, flat (qty. 4)	2190-0419
7	Screw—M4x10 (qty. 4)	0515-0380
8	Yoke	5062-2112
9	Cable—CRT/Control	M1722-61619

Figure 7-9



Recorder Assembly

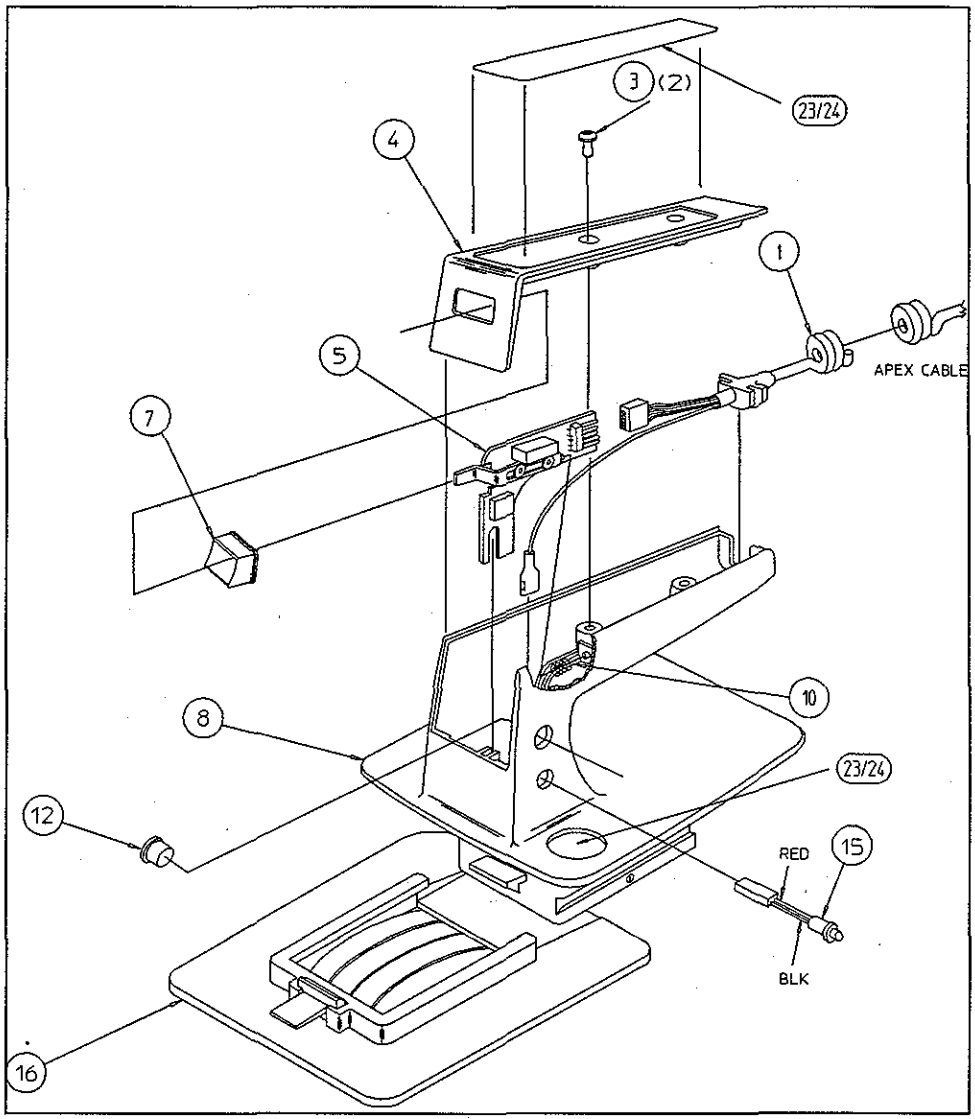
Table 7-8 **Recorder Assembly Parts List**

Ref. No.	Description	Part No.
	Recorder Assembly (white)(M1722A, M1723A)	M1722-69520
	Recorder Assembly (yellow)(M1722B, M1723B) (includes items numbered 1 through 21)	M1722-69529
1	Platen/door assembly (white), (M1722A, M1723A)	M1722-67410
	Platen/door assembly (yellow), (M1722B, M1723B)	M1722-67491
2	Right chassis	M1722-67303
3	Spring—door, right	M1722-27413
4	Gear, #1-64/40	M1722-47401
5	Gear, #2-50/20	M1722-47402
6	Gear, #3-64/16	M1722-47403
7	Gear, #4-32	M1722-47404
8	Motor assembly	M1700-67403
9	Retaining ring	0510-0238
10	Screw, M3 x 6 (qty. 2)	0515-0430
11	Spring, extension (qty. 2)	M1722-27418

Table 7-8 **Recorder Assembly Parts List**

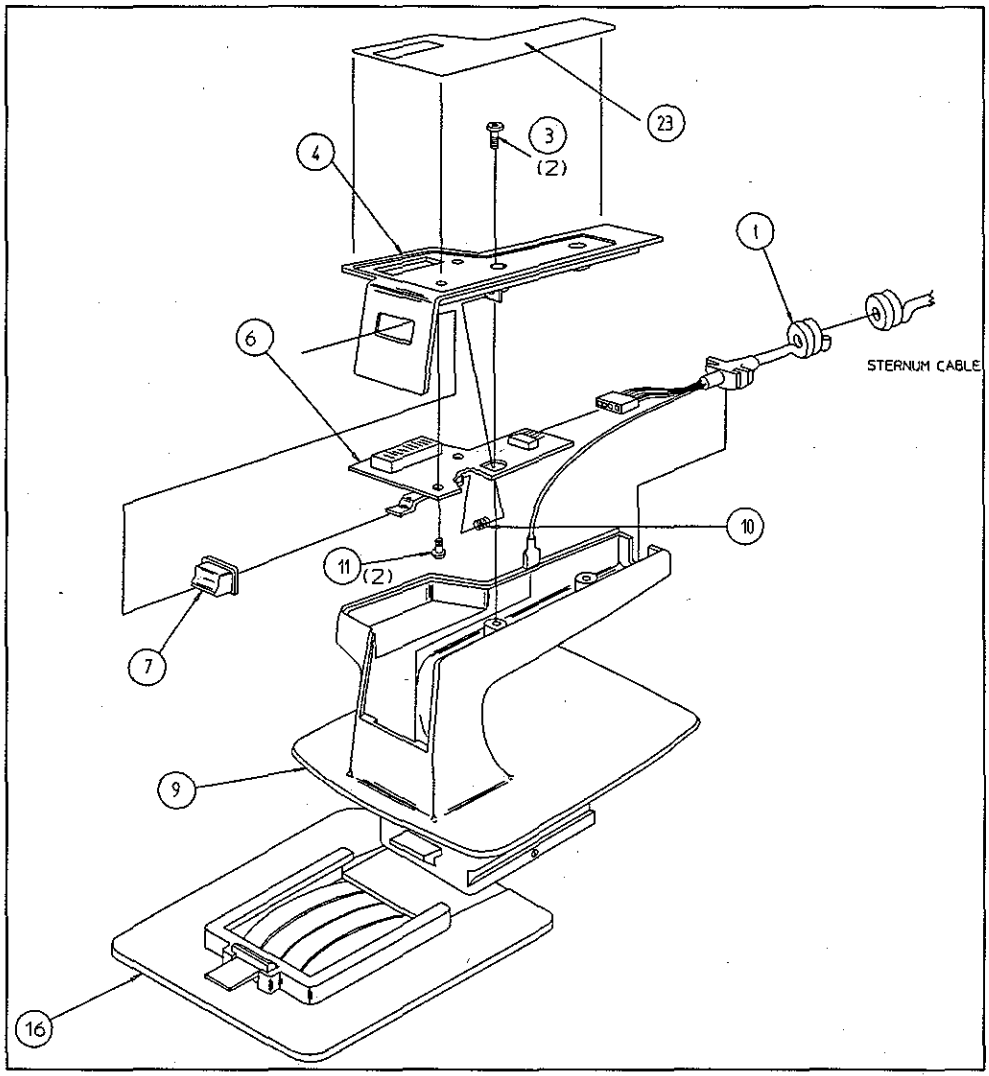
Ref. No.	Description	Part No.
13	Door—sliding (white), (M1722A, M1723A)	M1722-47211
	Door—sliding (yellow), (M1722B, M1723B)	M1722-47296
14	Printhead assembly	M1722-67450
15	Recorder PCA	M1722-60155
17	Spring—door, left	M1722-27419
18	Screw, M3 x 16 (qty. 2)	0515-0375
19	Left chassis	M1722-47302
20	Label (white) (M1722A, M1723A)	M1722-84580
	Label (yellow) (M1722B, M1723B)	M1722-84581
21	Paper ejector	M1722-07452
	Paper, thermal (not shown)	40457C\D

Figure 7-10



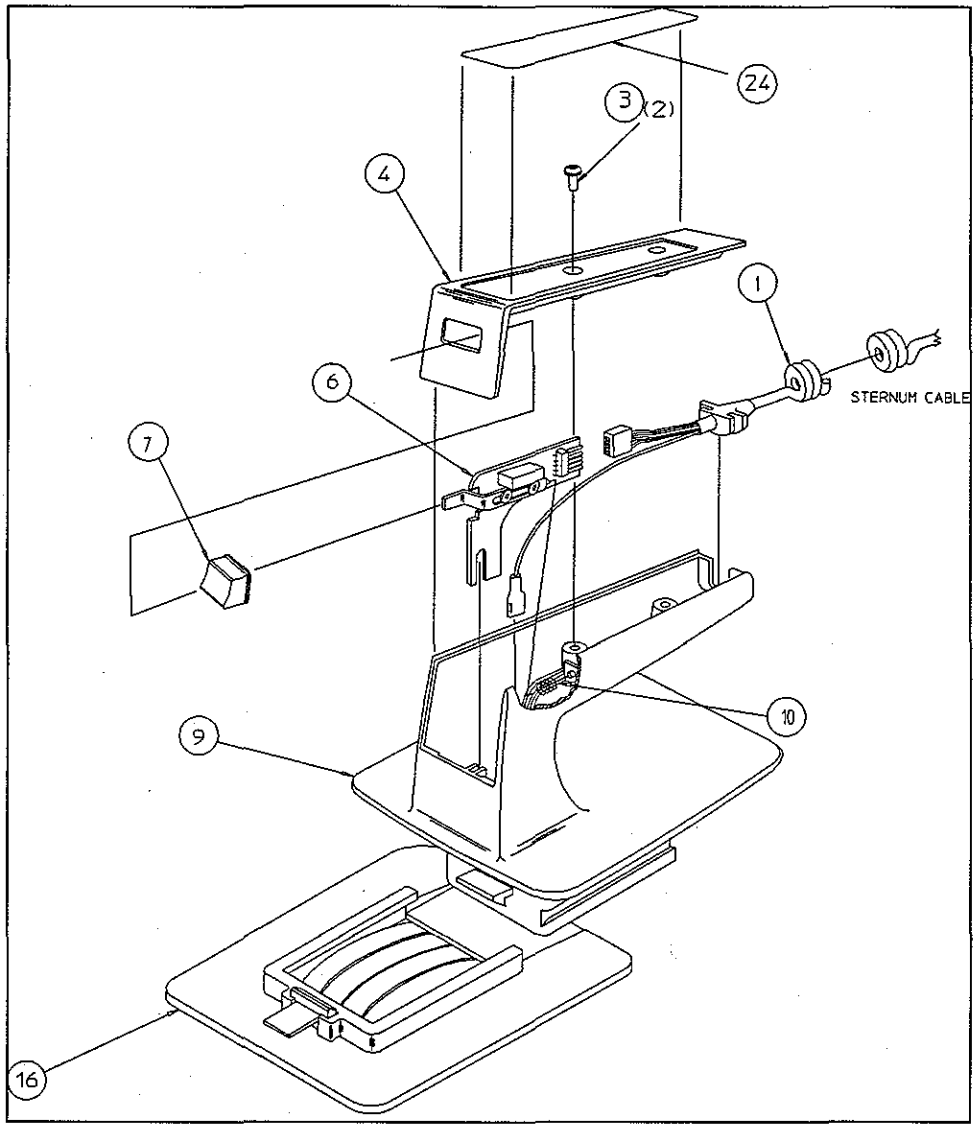
External Paddles Assembly–Apex

Figure 7-11



External Paddles Assembly–Sternum, with PCI

Figure 7-12



External Paddles Assembly—Sternum, without PCI

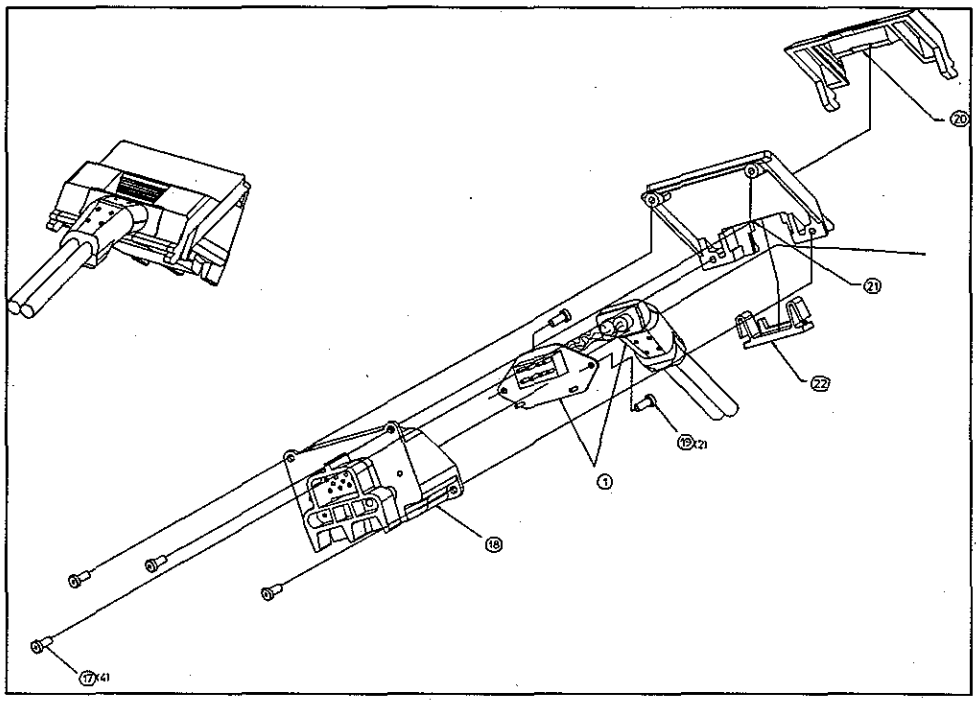
Table 7-9 **Paddle Assembly Parts List**

Ref. No.	Description	Part No.
	Paddle set, Ant/Ant w/PCI (white)	M1746A
	Paddle set, Ant/Ant w/PCI (yellow)	M1746B
	Paddle set, Ant/Ant no PCI (white)	M1747A
	Paddle set, Ant/Ant no PCI (yellow)	M1747B
1	Coil cord (Apex/sternum)	M1746-61600
3	Screw, PHMS 4-40 x 0.375 (qty. 2)	2200-0107
4	Cover - paddle (no PCI) (Apex/Sternum)	M1746-47203
	Cover paddle (with PCI) (Sternum)	M1746-47204
5	PCA - Apex paddle	M1722-60192
6	PCA - Sternum paddle (no PCI)	M1722-60194
	PCA - Sternum paddle (with PCI)	M1722-60190
7	Button, discharge	43100-47121
8	Paddle, Apex	M1746-47201
9	Paddle, Sternum (no PCI)	M1746-47210
	Paddle, Sternum (with PCI)	M1746-47202
10	Spring	43100-87400
11	Screw, PHMS 4-40 x 0.250 (Sternum w/PCI)	2200-0103
12	Charge button	M1746-47213
13	Fiber washer	3052-0682
15	Light indicator	43100-63000
16	Adaptor	M1746-62802

Table 7-9 **Paddle Assembly Parts List**

Ref. No.	Description	Part No.
23	Paddle labels (PCI)—English	M1722-84520
	Paddle labels (PCI)—French	M1722-84521
	Paddle labels (PCI)—German	M1722-84522
	Paddle labels (PCI)—Dutch	M1722-84523
	Paddle labels (PCI)—Spanish	M1722-84524
	Paddle labels (PCI)—Italian	M1722-84525
	Paddle labels (PCI)—Swedish	M1722-84526
	Paddle labels (PCI)—Japanese	M1722-84527
	Paddle labels (PCI)—Norwegian	M1722-84560
	Paddle labels (PCI)—Finnish	M1722-84561
	Paddle labels (PCI)—Danish	M1722-84562
24	Paddle labels (no PCI)—English	M1722-84320
	Paddle labels (no PCI)—French	M1722-84321
	Paddle labels (no PCI)—German	M1722-84322
	Paddle labels (no PCI)—Dutch	M1722-84323
	Paddle labels (no PCI)—Spanish	M1722-84324
	Paddle labels (no PCI)—Italian	M1722-84325
	Paddle labels (no PCI)—Swedish	M1722-84326
	Paddle labels (no PCI)—Japanese	M1722-84327
	Paddle labels (no PCI)—Norwegian	M1722-84360
	Paddle labels (no PCI)—Finnish	M1722-84361
	Paddle labels (no PCI)—Danish	M1722-84362

Figure 7-13



External Paddles Connector Assembly

Table 7-10

External Paddles Connector Assembly Parts List

Ref. No.	Description	Part No.
1	Coil cord	M1746-61600
17	Screw, 4-40, tapping (qty. 4)	0624-0600
18	Body, connector	M1722-47203
19	Screw, 2-56, tapping (qty. 2)	0624-0612
20	Latch, sliding (white)	M1746-47307
	Latch, sliding (yellow)	M1746-47397
	Latch, sliding (black)	M1784-45001
21	Cover, paddle connector (white)	M1722-47208
	Cover, paddle connector (yellow)	M1722-47298
	Cover, paddle connector (black)	M1784-47600

Table 7-10 **External Paddles Connector Assembly Parts List**

Ref. No.	Description	Part No.
22	Retainer, strain relief (white)	M1746-47207
	Retainer, strain relief (yellow)	M1746-47297
	Retainer, strain relief (black)	M1784-45002

Table 7-11 **Supplies List**

Description	Part No.
Patient Cables	
Patient cable 6-pin/3-wire AHA	M1731A
Patient cable 6-pin/5-wire AHA	M1732A
Patient cable 8-pin/3-wire AHA	M1733A
Patient cable 8-pin/5-wire AHA	M1734A
Patient cable 8-pin/3-wire IEC	M1735A
Patient cable 8-pin/5-wire IEC	M1736A
Trunk cable 12-pin/3-wire AHA	M1500A
Lead set 3-wire AHA	M1605A
Trunk cable 12-pin/3-wire IEC	M1510A
Lead set 3-wire IEC	M1615A
Trunk cable 12-pin/5-wire AHA	M1520A
Lead set 5-wire AHA	M1625A
Trunk cable 12-pin/5-wire IEC	M1530A
Lead set 5-wire IEC	M1635A
Paddles	
Internal paddle adapter (White)	M1740A
Internal paddle adapter (Yellow)	M1740B
Internal paddle set 7.5cm	M1741A
Internal paddle set 6.0cm	M1742A
Internal paddle set 4.5cm	M1743A
Internal paddle set 2.8cm	M1744A
Anterior/anterior paddle set (white), with PCI	M1746A

Table 7-11 **Supplies List**

Description	Part No.
Anterior/anterior paddle set (yellow), with PCI	M1746B
Anterior/anterior paddle set (white), no PCI	M1747A
Anterior/anterior paddle set (yellow), no PCI	M1747B
Pads	
Defibrillation/Pacing Pads (Adult AAMI)	M1749A
Defibrillation/Pacing Pads (Adult IEC)	M1749B
Defibrillation/Pacing Pads (Pediatric IEC)	M1749C
Defibrillation/Pacing Pads (Pediatric AAMI)	M1749D
Pads adapter (White)	M1750A
Pads adapter (Yellow)	M1750B
Pads adapter test load	M1781A
Battery, lead acid	M1758A
HP Redux electrolyte	651-1008-010
Recorder paper	40457C/D
Carry case	M1778A
Accessory pouch	M1779A
Wall mount hardware	M1722-80001

Cart Parts and Repair

Hewlett-Packard does not repair or supply parts for the MTRO-00336L cart. To obtain information about ordering parts or repair services, contact:

InterMetro Industries Corp.

North Washington Street

P.O. Box A

Wilkes-Barre, PA 18705-0557

Attn: Ben Stepniak, Customer Service

Telephone: 717-825-2741